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NOTES ON THE RIO NEGRO (AMAZONAS)

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Map following p. 276.

THE journey—unsuccessful in one of its main objects—was made during the first three months of 1917. The Rio Negro, though well known and graphically described by Wallace, Spruce, and Rojas, has never been either carefully or systematically mapped; and this fact, together with certain questions of historical, ethnological, and hydrographical interest, renders superfluous any apology for the following notes.

The objects of the expedition were first to make as complete a map as possible of the Rio Negro, and to include the Casiquiare canal and the Rio Guainia; second, to test the practicability of receiving signals from Radio, the Washington wireless station at Arlington, Va., with a portable field wireless set, thus simplifying the determination of differences of longitude between Washington as the prime meridian and field stations of secondary and tertiary meridians; and third, an investigation of the diseases of the river, their ætiology, prevalence, and prevention.*

Vexatious but unavoidable delays hindered the start of the S.Y. *Alberta*, 1350 tons, from New York, and more invaluable time was lost at Manáos; unusually low water occurred this year, and prevailed over a more prolonged period than is customary; and the absence from the upper river, on rubber operations elsewhere, of certain men who are indispensable for the heavy, hard work of portaging cargoes and dragging craft up through the broken and dangerous waters of the rapids, contributed to prevent as complete and thorough an accomplishment of work as was desired.

For the journey from Manáos to Santa Isabel, we enlisted the invaluable services of Fausto Pinheiro, the oldest and best pilot of the river, and chartered the river-boat *Inca*, to which were lashed the launch especially constructed for the work, and a steel varenga or lighter as auxiliary to the launch. From Santa Isabel to Camanáos the launch and lighter were worked up without difficulty, passing the Massarabi, one of

* An article by Dr. Wm. T. Councilman, Professor of Pathology at the Harvard Medical School, who accompanied the expedition, is soon to be published by the School of Tropical Medicine of Harvard University as its Third Report, and deals with the diseases endemic to this region.

the bad stretches of river, in fine style. At Camanáos, where the worst part of the whole river begins, all attempts to pass the lighter up, even a short distance, failed; but the launch ploughed through the bad water of cross-currents, whirlpools, and rapids to São Gabriel, which marks the halfway point of the great reef of rock between Camanáos and the mouth of the Caiari-Uaupés.

Returning on a second trip with supplies from the stranded lighter, the launch was badly knocked about, and a hole punched in the starboard side amidships. Temporary repairs were effected at São Gabriel sufficient to get the launch down to Umarituba, the residence of an old friend, a Portuguese trader, Senhor Antonio Fontes, where a good shipwright was available. Afterward the launch dropped back to Santa Isabel to bring up the remaining supplies left there, and on the return voyage was unable to get beyond a point just below Camanáos, on account of the very low water.

For a few days, early in February, there was a slight rise after very low water in December and January, but the rise was quickly followed by a fall, the level becoming lower than ever.* Neither canoes nor crews were available; and even had it been possible to pass the São Gabriel *cachoeiras* † to the still waters above, little or no work could have been accomplished, as the Casiquiare canal was reported as so dry as to be closed even to canoe navigation, and in the Caiari-Uaupés at Ipanore and Pinú-pinú the entire rock bed of the river was exposed, as it was westward from São Gabriel up the Negro. What water there was appeared to be below Camanáos, and it seemed possible that there might be sufficient in the Padauiri for the launch to ascend that as yet unmapped river.

From Umarituba Fontes sent me word that his big launch had been badly damaged owing to low water, but gave me the services of his very small one, which was used in getting our party and equipment from São Gabriel to the launch and lighter quartered below Camanáos, opposite Trinidad. With these by slow and painful navigation we picked a way down-river successfully to Umarituba, where the launch was run upon a sunken reef, and only pulled off twenty-four hours later with the aid of jacks and of all the male members of the settlement, to the number of thirty. Senhor Fontes, with characteristic kindness and hospitality, had previously made over to me one of his best Indians, a good pilot of the upper river; and the shame and chagrin of the poor fellow was such as to evoke strong protestations from his master as to his marked ability over the other Indian pilots aboard, who were in truth responsible to a large degree for the mishap.

* At São Gabriel the river fell steadily until February 13. On the 14th it commenced to rise, and during the nights of the 13th, 18th, and 19th there were heavy rains. On the 18th the river began to fall again, reaching the low mark of the 13th on the 21st and continued falling steadily through the remainder of the month.

† The Portuguese word to express both rapids and waterfalls, there being no distinction as in Spanish by the separate terms *randal* and *salto*.

The descent of the Massarabi, which at first seemed ominously ill-fated, was successfully achieved with João da Cruz, the pilot of the caxoeira, a fine type of old Indian, who resides on the right bank, and whose advice and skill are invaluable in the period of *rio baixo* or *secco*, *i.e.* low water.

When we reached the mouth of the Rio Preto, into which the Padauiri debouches some 15 kilometres above the former's confluence with the Rio Negro, no ascent was possible owing to a huge sandbank blocking the entrance, the river running out by the right bank over impassable shoals. The only alternative remaining was to trace the unknown north bank of the main river on the down journey, in so far as the low water would allow.

From Jauary to Esmeralda the launch and lighter were constantly grounding in the long shallows over sand; fortunately there is no rock in this portion of the river. Notwithstanding the continuous use of sounding poles, worked simultaneously both starboard and port, the water time and again would shoal abruptly from a fathom and more to less than 3 feet, and all efforts to find a channel by wading were ineffectual. The current invariably embedded the launch firmly enough in the sand to necessitate recourse to anchor, cable, and windlass for warping back both craft and getting them into the channel of entrance.

An old friend, Senhor José Netto, owner of the *Sitio Esmeralda* and now Superintendente of the department of Barcellos, very kindly lent me his Indian pilot after having dispatched him to our assistance off Esmeralda; and a few days afterward he himself and his launch joined our party at Barcellos, from which point we descended in company to Manáos, going by the north passage, or Parana-Anavilhana as it is called; this is dealt with farther on.

Before an intelligent idea can be formed of the characteristics of any particular river of the Amazons system, it is necessary to understand the hydrographical meaning of the terms "black water" and "white water" rivers. In maps of the Amazons and affluents, constructed from careful tracings by painstaking cartographers, two distinct types manifest themselves. One is marked by twists and turns, serpentine curves and meanders, ox-bows and loops, bordered by horseshoe lagoons and sac-shaped lakes. The other has no such tortuosities, but runs straight, its swings at no time deviating very far from the line of stream direction; and the shore hydrography is less complex.

The first trace is characteristic of the so-called white-water rivers coursing over a terrain of low declivity, the river having high, steep, concave, cutaway banks on one shore, and low, long, shelving, convex beaches or swamp littoral on the opposite: the river typical of lateral erosion and fluviatile activity, rich in sediment or detritus, and prototype of the vast level alluvial plains which go to form so great a part of the Amazons

basin. A good example of such a river is the Purus, the description and mapping of which by Chandless is a classic and model for all time.*

The second form is characteristic of rivers poor in sediment. The river-beds being more resistant are consequently less changeable and more lasting, and a more varied and permanent vegetation flourishes upon the banks than is the case with the constantly changing white-water rivers. There are two classes of rivers poor in sediment: those whose waters are coloured by humus, so that when viewed in any volume or depth they appear very dark or black; and others which lack both sediment and this characteristic colour. Typical of the true black-water rivers is the Rio Negro; while the Tapajos and Xingú are examples of rivers lacking both sediment and the distinctive colour.

The sources (*cabeceras*) of the Rio Negro are just east of the Papunáua, a tributary of the Inirida and near those of the Içana in long. 69° 30′ W., lat. 2° N., a big affluent of the Negro, which it enters just above San Felipe.† Intervening between the Papunaua and Içana is a narrow height of land, *terra firme* in character, flanked by immense swamps and lagoons, whence flow the Negro (or Guainia as it is known in its upper portion) and the Içana. The *caños* and *igarapes*‡ of both the Inirida and Içana furnish to the Indians an easy means of travel between the three rivers, and are used to a considerable extent by them. The Rio Negro is known by the name Guainia down to its confluence with the natural canal, the Casiquiare, from which point to where it empties into the Solimões just below Manáos, it is the Negro.§

The existence of the Casiquiare was made known to the world by the Jesuit father, Manoel Roman, in 1744, while on a visit of inspection to the missions of the Guaviare, where he met the Portuguese trader Francisco Xavier Morales, in whose company he passed through the Casiquiare to the establishments of the upper Rio Negro. This fact was announced to the world some months later by no less a personage than La Condamine, at a public session of the Paris Academy of Sciences. Spruce pertinently suggests that, inasmuch as the Rio Negro was formerly called Quiari, the

* *Geographical Journal*, vol. 36, p. 87, "The River Purus," Wm. Chandless.

† *Ibid.*, August 1914, "Further Explorations in the North-West Amazons Basin."

‡ Creeks, canals, or any small winding, tortuous streams. These usually lead from swamps and lagoons, resembling at first trench-like ditches; afterward shaded by a loftier and more luxuriant vegetation, they finally terminate in the great rivers.

§ The Amazons river is divided commonly into three sections: (1) The estuary, or *Estuario Amazonico*, including that portion of the main river and its affluents from where it enters the ocean to the mouth of the Xingú. (2) The Lower Amazon, or *Baixo Amazonas*, which is commonly reckoned as the reach of river from the Xingú to the mouth of the Negro. (3) The Upper Amazon, or *Alto Amazonas*, extending from the mouth of the Negro to the Andine Cordillera, called the Solimões as far west as Iquitos, and the Marañon, from there to its source in the Peruvian Andes. These are the divisions adopted by geographers, geologists, biologists, pilots, and others, and used for locating any tributary or district of the river.

ROCKY ISLAND IN RIO NEGRO ABOVE SANTA ISABEL

DENSE VEGETATION ON THE BANKS OF THE RIO NEGRO

TYPICAL ISLAND IN THE RIO NEGRO BETWEEN THE MOUTH OF THE RIO BRANCO AND SANTA ISABEL

RAPIDS OF CAXOEIRA FORTALEZA AT SÃO GABRIEL

VIEW OF RIO NEGRO AT CAMANÁOS

THE SERRA CAHURI LOOKING WEST FROM SÃO GABRIEL

word *casi*, Spanish for "almost," was possibly prefixed to the name of the main river and conferred upon its confluent from the Orinoco.*

The Negro flows through a valley of *terra firme* † with cliffs in many places (*barreiras* or *barredas*, as they are variously termed). Usually in the upper part of these cliffs are layers of reddish or mottled clay overlying grey. As far up the river as Ayrão the barreiras have a pinkish hue, and the rock where exposed is sandstone.

As a rule the Rio Negro runs straight, with forest bordering it in a permanent selvage, not falling away in masses as the floods recede, as happens on the Amazons and other white-water rivers. Thus the Negro is entirely free of the masses of logs and *débris* encountered on the Amazons and Solimões. When the river is low the steeply sloping banks, whether rock or earth, are covered for miles with a network of rootlets and vegetable "rigging" from the trees, which gives to it a dense fringe.

At Manáos the river is about 4 miles wide, and just above it widens out, narrowing a short distance beyond Paricatuba, but soon broadening again into the lake-like expanse known as the Boiaçu, a stretch much dreaded on account of the strong winds that blow across it from the east, beginning an hour or two after sunrise and continuing until afternoon. Night, when the wind has dropped and the swell subsided, is usually chosen for crossing in either launches or canoes.

In places the great width of the river is broken by long islands separated by narrow channels; elsewhere the water meets sky unbroken as the ocean, unless some distant forest-covered island or mainland becomes miraged above the horizon. For the 400 and more miles from Manáos to Santa Isabel it is for the most part impossible to distinguish the mainland, owing to the innumerable islands with which the river is filled, and to the necessity of keeping in the navigable channel, especially during low water, when the great white sand beaches run out for long distances into encircling pockets, or thrust extensive bars diagonally across

* 'Notes of a Botanist on the Amazon and Andes,' R. Spruce, vol. 1, p. 357; Baena, 'Ensaio Corographied solise a Provincia do Para,' p. 530.

† The terms *terra firme*, *varzea*, and *igapó* are generally confusing to all but the experienced student of Amazon hydrography, or to the native. *Terra firme* is applied to very old land always above the level of inundation, and its relief well marked. It consists of fluvial terraces, tablelands, canyons, valleys, and troughs, whose surface is covered with a sandy or clayey material. *Varzea* (alluvium) is commonly used to designate land subject to annual inundation; but all varzea is not necessarily periodically flooded, and at times it is difficult to differentiate between high varzea and low terra firme, especially when the former is covered with thick forest concealing its slight relief and vegetation common to both varzea and terra firme. The term *Igapó* is frequently applied to any land of very recent alluvial formation which is flooded at certain seasons; but to the Indian and Brazilian it implies a stretch of wood standing in water that remains ponded up for some time after the floods have subsided, or even is permanent. The igapós of the varzea and terra firme are swamp arising in the first from incomplete levelling in the process of alluviation with consequent insufficient drainage, and in the second because of natural depressions of the terra firme. See "Mattas e Madeiras Amazonicus," Prof. J. Huber, *Boletin do Museu Gœldi Para*, vol. 6, 1909.

the river-bed, enough submerged to render the channel indistinguishable, and a barrier to all craft except canoes of *ubá* and small *montaria* type. When there is wind and current, riffling and rips indicate shoals, as does the more translucent golden-brown colour of the water in any sunlight; but frequent violent wind storms, with consequent heavy and dangerous seas, constantly menace the navigator of launches and batelões.

The beaches of the Negro are composed of a very white fine sand, partly occupied by a bush vegetation abundant in species, with woods behind them for the most part far from lofty, but clothed with a dense foliage varying from dark green to olive. Growth is probably modified not only by the xerophytic structure of the vegetation, but the sandy nature of the soil, which is not to be compared with the rich humus and loams of the alluvial varzeas of the white-water rivers.

White-water rivers have a more or less normal vegetation. The land on the convex side is usually incipient varzea that at very low water is prolonged into sandbanks (*praias*). Just above the beach the humus or mud commences upon which flourishes the first vegetation of a willow-like growth known as *oeirana*, giving way to *imbaübas* (cecrops) and coarse grasses of cane and rush. The imbaübas sometimes form a transition wood, the imbaubal, just before the higher wood of the true varzea begins, with certain palms, heveas, ingas, acacias, sapuims, figs, and laurels, to mention only a few of the innumerable species. On the opposite concave side, where the bed of the river is deepest and the current strongest, the steep bank is eaten away by lateral erosion. The banks usually collapse in the period between high water and low, as the river drops, the undermined bank being borne down by the superimposed weight of the trees. These forests of the high *varzea* in many cases rival in size and height (such as the Sumauma, Cedro, Castanha, Assacu, and Cummaru) all but the very loftiest trees of the *terra firme*.

Nowhere, however, does the Rio Negro show any such successive and characteristic arrangement of growth; and though the rather low and level appearance of the forest might make one hesitate at first in assigning it to *terra firme*, its variation from the latter type is explained by the sandy soil and consequent modification of the vegetation; and the attribution is confirmed by the absence of meanders and the presence of a hard, resistant river-bed of rock or sand.

At the confluence of any black-water river with a turbid one, the conditions governing the vegetation are dependent upon the power of the black-water stream to dissipate the sediment of the turbid, or itself be pushed back and its riparian vegetation influenced by the river of alluvium. Thus for several miles below the point where the Rio Negro debouches into the Amazons the dusky volume of the former is distinctly discernible along the left bank of the main river, in striking contrast to the muddy flood along the right or south bank. On the left bank the characteristic vegetation of the Negro is maintained to its very mouth; but on the right

bank for some little way above the junction with the Solimoes are *igapó* and *varzea*, owing to a partial merging of turbid with the clear waters, which interferes with the normal work of levelling, the detritus of the sediment-bearing stream is held up and a varied vegetation of igapó type succeeding.

Twenty miles above Manáos, where the Negro spreads out into the Boiaçu, is a veritable archipelago, and on the northern side of the river is the entrance to the Parana-Anavilhana, a channel separated from the main river by a continuous series of islands, large and small, extending as far as Ayrão. It is an exceedingly picturesque passage, narrow and winding, with steep banks for the most part fringed to the water's edge by a dense bush vegetation, and surmounted with a screen of wood more lofty than most of the Negro forests. At only two or three points along the entire course of 112 miles is the main river visible, and then only as a waterway between close-lying islands. Into this parana empty the rivers Cuiéras, Apuáhu, and Curiáhu, whose sources are apparently near that of the Urubú, and separated by a narrow divide. The latter stream falls into the Amazons near Itacoatiara (formerly Serpa). A few days up the Cuiéras is a high hill called Minuta, like the isolated hills characteristic of the Negro region higher up. Soundings made along the Anavilhana just after lowest water never gave less than 3 fathoms, and at the mouths of the tributaries there was no bottom at 5 and 6 fathoms.

From Manáos to Santa Isabel, the larger tributaries are on the north bank of the river, and their flow is in general from north to south. Between Santa Isabel and São Gabriel two important tributaries, the Tefa and Marié, enter on the south bank, the Marauhía and Cauaburi on the north. Above São Gabriel, the big tributaries all enter on the right bank, of which the Caiari-Uaupés is the largest and longest.

Opposite Carvoeira the Rio Branco, a large river of white water, as its name implies, falls into the Negro by three mouths, and a great expanse of the latter at this point is filled by many ill-defined islands of dense jungle and swamp, broken by countless channels (parana-miri) so extensive as to render the right bank difficult to locate, a formation to which the term *chavascal* is applied.

Just above Barcellos on the north bank, the Aráca—a black-water river whose flow is approximately parallel to the Negro—enters the latter, after receiving the Demini, a white-water river. In like manner the Preto, a black-water river, enters on the left bank and at 15 kilometres above its mouth receives the Padauiri, a white-water river. The Padauiri runs north to south from its sources (*cabeceras*) near the Venezuelan frontier.

It is not until near Santa Isabel that rock appears in any quantity, but from here the whole river-bed is rock strewn. In the lower river what rock there is seems to be sandstone, but from the mouth of the Branco onward granite prevails. Just below Santa Isabel the river narrows, and from there up many of the islands are rocky and very picturesque. Above

Santa Isabel the apparent dead level of the forest plain is broken by hills or serras that rise abruptly from it. The angle of slope increases, while the width decreases and the current is stronger. At Massarabi and Camanáos are long and dangerous rapids (caxoeiras), the spume of whose cross-currents, violent whirlpools, and dangerous waves is seen for a long distance below the broad reefs of granite over which the river rushes.

The São Gabriel rapids extend from Camanáos to the mouth of the Caiari-Uaupés, a distance of more than 30 miles, passing at places between high walls of rock, zigzagging swiftly, and requiring the greatest skill, keenest sight, and coolest judgment of the expert Indian pilots who navigate the launches and canoes. From San Felipe, just above the mouth of the Caiari-Uaupés to Santa Isabel, a batelão with a crew of eight Indians takes five days; but eighteen days and more are required for the return journey.

The hills or serras stand singly or in small groups, rising abruptly from the flat. The vegetation of their slopes is that of the surrounding *terra firme*, and the rock where exposed is precipitous with crested arêtes. The serras are generally indicative of caxoeiras or rocks choking the river, the banks on either side being lined with Cyclopean masonry. On two former journeys, working from the Colombian Cordilleras* to the Rio Negro, hills like these were first seen on the Caiari-Uaupés and Inirida in long. 69° 30′ W. West of that meridian the hills, though arranged in the same way, and presenting a like aspect from a distance, proved always on close inspection to be sandstone.

The Tefa and Marié are of interest in that while both flow in a general west to easterly direction, the former flowing through a very flat country has many tortuosities, with neither rapids nor caxoeiras throughout its course, whereas the Marié is wildly picturesque, broken by caxoeiras, and flanked by rock terraces or serras of a mountainous character. According to my informant, Senhor Antonio do Abreu Fernandez, who owns the big island of Surú-hiny, just below the mouth of the Marié, and who ascends that river annually, it is possible at high water to go up for seven days in a launch; and the surrounding country abounds in game, such as tapirs, peccaries, monkeys, ducks, turkeys, paujils, with many fish in its waters.

Animal life on the Negro itself is not very abundant, as animals, like Indians, prefer the smaller streams for their habitations and activities; it is only in extremely isolated or totally uninhabited districts that any of the larger animals are to be found in abundance, as on the upper reaches of the Inirida and the belt of country extending from the Guayabero to the Mesaya. On one occasion I saw a large sloth swimming across the Rio Negro just above Curituba Island, and again one far out in the river on a sandbank off Vista Alegre.† Otters are fairly numerous on the north side

* See *Geogr. Journ.*, June 1910, "The River Uaupés"; *ibid.*, August 1914, "Further Explorations in the North-West Amazon Basin."

† Cf. Bates, 'A Naturalist on the Amazon,' 1st edit., vol. 2, p. 57.

of the lower river, while turtles, pacas, cutias, coatis are plentiful enough, and water boas are sometimes encountered. In the campos above Santa Isabel deer are common, and skins of both the spotted jaguar and the red puma are exhibited by natives and traders. At Carvoeira, Senhor Leonidio Caldas Neves breeds turtle upon a large scale, supplying the Manáos market, as well as the traders up-river, who are good customers, as turtle meat is one of the staple articles of diet. Alligators are found only in the lower Negro, and do not go much above Moura. At certain seasons the river abounds in fish, but at dead low water and in full flood they are not so plentiful as on a rising or falling river. A rich field awaits the ichthyologist here; for the species are innumerable, and collecting is expedited by the countless fishtraps along the river-banks, and the nets that every native casts with skill. Among the many edible varieties are the tucunare, pirarucu, tambaqui, pacú, mandí, aracu, piau, and jandía.

Unlike many of the larger Amazon rivers that have colonies of native Brasileros settled upon them, engaged in trade and the exploitation of rubber, there are very few upon the Negro, as that river appears to have been appropriated by the Portuguese. There are few families, but they are all-powerful on the river, and usually connected by both marriage and trade interests. Caste distinction is strong, and many gradations occur, as must be with a mixed population of whites, mestiçoes, pure negroes, and the native Indians. Most Portuguese marry Indian women, who are of inestimable value to their husbands, for without the knowledge of the native dialects that these women possess, and their influence over their own people, it would not be possible for the ruling class to maintain the condition of Indian vassalage that exists: a condition almost feudal not only in the number of retainers and servants, but in the large area of territory that a single individual controls and works.

The state of Amazonas has an area of more than 700,000 square miles, traversed by the greater part of the Solimões section of the Amazons River and the Rio Negro. Its Governor, chosen every three years, resides in Manáos. The state is divided into departments, four of which go to make up the Brazilian part of the valley of the Negro. Each of these is governed by a *Superintendente*, with a municipal authority, the *Intendente*, in the principal town or village of each department. The *Superintendentes* are responsible to the Governor, and, in addition to administrative duties, exercise authority over all Indians in their particular domain, or over as many as can be apprehended: a lucrative prerogative for one engaged in commercial as well as political life.

In the last two years there has been a revival of the old Missions formerly established along the river, under the direction of Padre Lourenço Giordano, a Salesian father, and of his assistant Padre João Balzola, men whose experience among the natives of the Brazilian wilderness extends over many years of praiseworthy efforts and sometimes gratifying results. Until however the Roman Catholic missionaries, or

rather their sponsors, recognize the necessity for education of more practical value than mere theology, the results cannot be but disappointing in the end. I am sanguine a good race can be evolved from the Indian of the Rio Negro and its big western tributaries, but only by teaching self-respect, some knowledge of Spanish or Portuguese, and a little elementary education beyond theological dogma. The common language of the Rio Negro is the Tupi-Guarani or its derivative Língoa-Gerál, which throughout Brazil is used in the names of indigenous tribes, towns and villages, rivers, hills, animals and plants. From the writings of the Padres Anchieto, Montoya, and other Jesuits of the seventeenth century "Tupi" or "Nheengatu" appears to be the survival of a number of slightly varying dialects spoken by the natives of what to-day forms Brazil, and its use extends from the Venezuelan frontier on the north to Paraguay on the south. Among the Indians of the Rio Negro not only do most of the legends and myths of Tupi survive, but the "dabocuris" or weird dances, partly religious, partly festive, are practised in the orthodox manner, though they are not prolonged over the number of days nor do they degenerate into the licentious saturnalia common in the great malocas of the Caiari-Uaupés.

Inland from the middle and upper Rio Negro, extending westward along its tributaries to about the 70th meridian, is a country inhabited by Indians of Aruak, Karib and Betoya stock, who form several tribes living in communal fashion in great houses termed malocas, cultivating big areas of cleared forest land on which they grow indigenous tubers and fruits.

On the right bank of the Rio Negro around the Teía, Marié, and Curicuriari, and extending up the Caiari-Uaupés and its affluents, and as far west and south as the Japura (Caqueta), is another type of Indian, the "indio do matto" or Makú. These have no fixed abodes or plantations, nor do they use the chattels of the ordinary Indian, such as hammocks, canoes, and axes, but roam ceaselessly through the forest, living by hunting and fishing, or on the uncultivated fruit of the country. They are among the most miserable of all the aborigines of the Brazilian Amazons, being hunted down by the stronger communal tribes, who impress them for field and house work or dispose of them to unscrupulous traders. At times, however, I have noticed a pusillanimous dread and wholesome respect for the despised "Indios do matto" on the part of "racionales" passing through desolate and reputedly dangerous districts. In March 1908, when at Jutika on the Caiarí-Uaupés, I met a chief of the Desana tribe from the Paaporí, who stopped to make a call, and in his retinue he had Makús as concubines and arm-bearers. This was in a district where there is general distrust and fear of some of the settled tribes also, especially the neighbourhood of the Rio Kerari, opposite the mouth of which is Taapira-igarape, up which I was taken in February 1908 by a company of naked Indians to the big maloca of the old Tuxaua

Marcellino, a place to which the Brazilian and Columbian seringueros and racionales give a wide berth, as has been told me many times by the men themselves (see *Georg. Journ.*, June 1910, "The River Uaupés").

In March of this year, when stopping overnight at the mouth of the Marié, the kind and obliging old trader whose house is situated at that place, had rounded up for our inspection the following morning some Makú of the neighbouring forest. They were a wretched-looking lot of dirty, unkempt, naked savages. When taken into servitude they are, as a rule, kindly treated, and with sufficient nourishing food and protective clothing fare far better than in their freedom and nakedness.*

In the households of some of the traders on the Rio Negro, whose dealings or matrimonial connections have brought them in contact with Venezuelan Guayana, can be found Guahariba Indians, especially young boys; and the Guaharibos themselves come to the Rio Negro for trade from the cabeceras of the Orinoco by the Padauiri and Marauhai rivers. Other Indians from the big and powerful tribes of the western tributaries of the Rio Negro are found as patrões, pilots and crews in the batelões and launches of the seringueroes and traders, who are constantly passing to and from Sta. Isabel and the up-river districts.

The map has been constructed from compass traverses and distances by patent log and time, taken throughout the journey up and down river, adjusted by astronomical observations at the places indicated taken with a 6-inch theodolite fitted with micrometer microscopes and electric attachments (Troughton & Simms).

Latitudes are from pairs of circummeridian altitudes of north and south stars and of the sun. Longitudes are by chronometric differences from Manáos (Point Ismail, 60° 3′ 15″), checked by wireless (see below). An 8-day chronometer and five half chronometer watches (Blockley) were carried.

The following rates of the chronometer are of interest as showing what can be accomplished on launch work in bad waters and trying climate. The chronometer was twice taken ashore, carried overland some distance at São Gabriel, and taken off the launch when stranded at Umarituba.

1916.

		Rate in seconds per day.
New York	Nov. 8–14 ...	+1·7
Solimões	Dec. 25–31 ...	+1·1

* Ehrenreich terms the Makú "Heloten" or serfs, and says that Makú is an Aruak term of opprobrium, applied by the more highly developed tribes of the Aruak stock to the lower ones of different origin with whom they come in contact. Martius considered it applied, without regard to descent, to all those wandering tribes hated and hunted down by the settled Indians. Koch-Grunberg considers them a remnant of a race bearing culturally the stamp of great antiquity, differing radically from the other tribes around them.

	1917.		
Manáos	... Jan. 11–14	...	+1·69
Sta. Isabel ...	... „ 23–29	...	+0·63
São Gabriel ...	... Feb. 9–15	...	+1·74
„ „ ...	... „ 15–22	...	+1·19
Jauary	... Mar. 13–15	...	−0·10

So far as possible time observations were repeated at the same points on the up and down voyage.

Santa Isabel and Esmeralda were established as secondary meridians by the successful reception of wireless signals from Radio, Virginia (Washington), good time sights being obtained just before and immediately after the signals. The interesting report of the wireless operator is appended.

The means of pairs of observations for azimuth at São Gabriel gave a compass variation of 2° 44′ East, and at Barcellos 1° 15′ West, showing that the variation is zero near Santa Isabel.

The provisional heights on the map have been computed at the R.G.S. from aneroid readings at various stations along the route, and at Manáos, taken as 26 metres above sea-level.

APPENDIX

NOTES ON THE DETERMINATION OF LONGITUDE BY WIRELESS TELEGRAPHIC SIGNALS FROM ARLINGTON

John W. Swanson

The radio equipment consisted of a supersensitive regenerative Audion set, made up of the following apparatus:—

An Oscillation Transformer especially constructed for the reception of long wave-lengths, eliminating dead ends and capacity losses.

Three general Radio Condensers, having a range from ·00002 mfd. to ·00073 mfd.

Two pairs of Baldwin Mica-Diaphragms Head-band Telephones, wound to a resistance of 500 ohms.

Six Audion Detectors (De Forest).

Two 6-volt Storage Batteries for lighting the filament of the Audion.

A 10-ohm Rheostat used in series with filament circuit to regulate brilliancy.

Three high-voltage Batteries giving a maximum of 120 volts.

A Graphite Resistance of 2500 ohms used in shunt to Batteries to reduce to the necessary potential for the wing circuit of the Audion.

Two especially wound Loading Inductances to eliminate capacity losses; one for the primary and one for the secondary circuit. These were put in circuit when wave-lengths higher than 2500 metres were to be received, such as the high waves emitted by Sayville, New York, and Hanover, Germany.

A Grid Condenser of fixed value treated in paraffin to regulate leakage.

A Leak Resistance used to shunt the grid and plate, thereby preventing the Audion from being paralyzed by sudden severe static discharges.

A Hand Generator giving a maximum output of 6 ampères at 12 volts, for charging filament storage batteries.

All apparatus except the batteries and the hand generator fitted neatly into a fibre case, and made a high-grade portable receiver for such delicate work as the reception of Arlington under the trying and abnormal conditions of the tropical forest.

The Amazon Valley is probably the worst place in the world for wireless work. Where a 5-kilowatt transmitting set would be able under favourable conditions to establish communication, in the valley a set of ten times that capacity would be required. The absorption of the damped electro-magnetic waves by the dense tropical forest is tremendous. Moreover it is the head-quarters of "static," so much dreaded by radio operators, and "radio shadows" exist here extensively. These shadows are due to many causes, but I believe, after much experience in the tropics, that the most important are heavily charged low cumulus clouds that hang over the antennæ of a receiving station.

In view of the unfavourable local conditions on the Rio Negro, the percentage of complete signals received is good. The failures at São Gabriel, Umarituba, and Manáos were due only to bad local conditions. Considerable difficulty was experienced owing to the interference by the Amazon stations, which work on a very broad wave in many instances identical with that of Arlington, which makes it impossible to tune them out. Every effort was made to induce these stations to close down during the time signal, but without avail. Before further longitude work on the Amazon is attempted, the Brazilian and Peruvian Governments should have their radio stations properly tuned or close down during the period of time signals, from 9.55 to 10 p.m., Standard Time, 75th meridian.

The results obtained seem to show that the phase of the moon has a great deal to do with the reception of long-distance stations, as the best results were obtained with no moon or when it was in the first quarter. I am of opinion that the light of the moon has the same damping effect on electro-magnetic waves as that of the sun, only to a less degree. The wind has no effect on radio waves.

I found the use of climbing irons of little value, as the trees in the majority of cases were too great in diameter, the bark too thin and slippery, or the wood too hard. The climbing spikes were used only six times. It was much quicker and much more simple for an Indian accustomed to manual labour in the broiling sun to climb a tree monkey fashion, with the use of a sipo vine or grass about his feet to keep them spreading. An Indian could be at the top of a 100-foot tree while I was adjusting the irons on my legs.

The best method of erecting an antenna between trees I have found to be as follows:—

The climber is given a measured chalk-line, measuring up to 200 feet, and proceeds up the tree while the man in the field uncoils the necessary antenna wire and places the insulators, the lead in and guy wires. Upon the signal the man in the tree drops the chalk line, and after measuring the height the guy wire holding insulator and antenna is hauled to position, whereupon the chalk line and necessary surplus guy-wire, after being passed around a staple branch, is lowered to the base of tree where it is made fast. A similar process occurs at the opposite end, except that the aerial is hoisted into position from this point. The man in the tree prevents the wire from cutting into the branches by guiding it to and fro with a strong stick, while the man at the base raises the antenna by using a 10-foot piece of timber as a lever, which he raises to the height of his chest, taking in the slack on the upward stroke. The foregoing procedure will readily be appreciated by those who have spent hours in erecting an antenna in the forest, breaking branches to clear the wire, and unreeling entanglements. It also avoids the necessity of climbing the tree a second time in order to lower it.

I have found that a single wire, inverted L type antenna, about 700 feet, the

most efficient for a wave-length up to 2500 metres, with this regenerative Audion set, as it allows a large, loose coupling between the Primary and Secondary circuits, an aid to the elimination of "static." A small antenna accumulates less static than a large; an aerial of the foregoing size is comparatively easy to erect, and large trees at this distance apart are more readily found. At Sta. Isabel, on January 27, signals from Washington were received, using an antenna 100 feet in length, 50 feet high at one end, 15 feet at the other, with but little static. A large antenna with this receiver is not an advantage. The main thing to be remembered is that the antenna should give a large clearance in the direction of Arlington; for instance, on a river running east and west the antenna should invariably be erected on the south bank.

The best "earth" was obtained by driving a 5-foot steel rod into the clay bottom of the river. But at Sta. Isabel, while experimenting, I found that a spike driven into the roots of a tree makes a good earth. When there is doubt as to the efficiency of the earth, a counterpoise or artificial earth should be constructed by stretching twice the amount of wire in the antenna on the ground and directly under it, earthing each end of this wire.

A feature of the regenerative Audion receiver is its behaviour in bad static or atmospheric conditions. Its success is due to the fact that the receiver combines the characteristics of the two most effective static eliminators known; the balanced valve and the heterodyne receiver. The balanced valve shields the ear from the loud crashes which temporarily impair its sensitiveness; and when the Audion is generating it is possible by proper manipulation of the circuits to reduce the static considerably.

The receiver should be kept from rough handling and continuous vibration. Three out of six of my Audion bulbs broke from these causes. The bulbs should be carefully packed with cotton into a strong wooden box, and all the apparatus protected from damp. This type of receiver requires a skilled operator.

This report is made to help in perfecting the results in future expeditions. Possibly in the near future time signals will be transmitted on Arlington's undamped set; then their reception will be more simple and certain.

Arlington sends time signals on a wave-length of 2500 metres from 9.55 to 10 p.m. standard time, 75th meridian. During this interval every tick of th clock is transmitted except the twenty-ninth second of each minute, the last five seconds of each of the first four minutes, and finally the last ten seconds of the last minute. . The 10 p.m. signal is a longer contact after this longer break.

NOTES ON THE CONSTRUCTION OF A GENERAL MAP OF AFRICA, 1/TWO MILLION

Arthur R. Hinks, M.A., F.R.S., Secretary R.G.S.

Read at the Afternoon Meeting of the Society, 6 May 1918.

DURING the past eighteen months we have, as opportunity offered, made preparations for the compilation of a General Map of Africa on the scale of 1/Two Million, being convinced that such a map would be required long enough before we were able to complete it. The enterprise has now reached the point at which three sheets have been

delivered to the Geographical Section, General Staff, and a dozen more are in a forward condition. It may therefore be an appropriate moment to put together some account of the more interesting points that have arisen in the course of the work.

The only existing General Map of Africa is the old French 1/Two Million, now many years out of date; the new German map on the same scale, which we illustrated recently (*Geo. Journ.*, March 1918, pp. 140 and 141), is to be restricted apparently to "Mittelafrika." The several series of African maps on different scales produced by the Geographical Section, General Staff, provide for considerable regions of the continent, but are not sufficiently advanced to make a comprehensive whole. The admirable sheets of the international series produced by them within the last few years deal with East Africa, British and German. To cover the whole continent requires 140 sheets of the standard 1/Million Map, six degrees by four, and its completion must be a work of many years. There seemed room in the interval for a general map on the scale of 1/Two Million—a scale which for a considerable part of Africa is adequate to represent existing material. Each sheet of the proposed map will cover four sheets of the International Map, and be therefore of the same linear dimensions. The Index Diagram shows that Africa cuts up very conveniently into sheets of this size, and that a fair number of the sheets cover natural regions satisfactorily, especially if one reserves the liberty of breaking the margins occasionally, while avoiding the temptation to alter the fundamental arrangement of the sheet lines.

The choice of a projection presented points of interest. Taking as first principles (*a*) that each sheet must be bounded by meridians and parallels; (*b*) that such boundary must be symmetrical; (*c*) that each sheet must fit the adjoining sheets accurately; and (*d*) that a block of at least four sheets must be capable of mounting without serious discontinuity, one turns naturally in the first instance to the projection of the International Map (modified polyconic) to see if this will serve for the larger sheets of the new map. It will be remembered (see paper on the 1/Million Map, *Geo. Journ.*, July 1915, vol. 46, p. 29) that the angles at the corners of sheets on this projection are all slightly less than right angles, and that consequently though each sheet will fit the adjoining sheet a block of four will not build up quite perfectly. In the 1/Million maps the defect is so small that it could be got over by slight squeezing of the paper in the process of mounting; but for the 1/Two Million maps the defect is larger, and there must be a slight want of continuity, not very serious upon this scale, but indicating that we have arrived here at the limit of usefulness of the International Map projection. The defect in question would become inconveniently large if one tried to use the same projection for, let us say, sheets of the same linear dimensions on a scale of 1/Four Million.

The tables for the projection were very kindly computed for us by

Mr. A. E. Young, to whom we have been indebted in the past two years for much valuable assistance in such matters.

Tables for the Projection of Maps on the Scale of 1/Two Million, by an extension of the Projection for the International Map of the World.

TABLE A.

Natural and Corrected Lengths on the Central Meridian.

Latitude.		*Natural length of 8° on scale 1/2M: inches.*	*Correction.**	*Corrected lengths for plotting: inches.*
From −4° to	+ 4°	17·413	−·048	17·365
0	± 8	·414	48	·366
±4	±12	·416	47	·369
8	16	·420	46	·374
12	20	·426	44	·382
16	24	·433	42	·391
20	28	·442	40	·402
24	32	·451	37	·414
28	36	·462	34	·428
32	40	·474	31	·443
36	44	·486	28	·458
40	48	·498	25	·473
44	52	·510	21	·489
48	56	·523	18	·505
52	60	·535	15	·520
56	64	17·545	12	17·533

* This correction to the central meridian is $-·048 \cos^2 \phi$, where ϕ is the mean latitude of the sheet. The meridians 4° on each side of the centre are thus made of their true length, and the error of the bounding meridians 6° from the centre is numerically equal, but of opposite sign, to that of the central meridian.

TABLE B.

Co-ordinates in inches of the Intersections of the Meridians with the Top and Bottom parallels.

Longitude from the Central Meridian.

Latitude		1°	2°	3°	4°	5°	6°
0°	*x*	2·192	4·383	6·574	8·766	10·957	13·149
	y	·000	·000	·000	·000	·000	·000
4	*x*	2·186	4·372	6·558	8·744	10·930	13·116
	y	·001	·005	·012	·021	·033	·048
8	*x*	2·170	4·340	6·510	8·680	10·850	13·020
	y	·002	·010	·023	·042	·066	·095
12	*x*	2·144	4·288	6·432	8·575	10·718	12·862
	y	·004	·015	·035	·062	·097	·140
16	*x*	2·107	4·214	6·321	8·427	10·534	12·640
	y	·005	·020	·045	·081	·126	·182
20	*x*	2·060	4·120	6·180	8·239	10·298	12·357
	y	·006	·024	·055	·098	·153	·221
24	*x*	2·003	4·006	6·008	8·011	10·013	12·015
	y	·007	·028	·064	·114	·178	·256
28	*x*	1·936	3·872	5·808	7·744	9·679	11·613
	y	·008	·031	·071	·127	·198	·285
32	*x*	1·860	3·720	5·580	7·439	9·297	11·155
	y	·008	·034	·077	·137	·215	·309
36	*x*	1·775	3·550	5·324	7·098	8·871	10·643
	y	·009	·036	·082	·145	·227	·327

40	x	1·681	3·362	5·042	6·721	8·401	10·079
	y	·009	·037	·085	·151	·235	·339
44	x	1·579	3·158	4·736	6·313	7·890	9·465
	y	·009	·038	·086	·153	·239	·344
48	x	1·469	2·938	4·406	5·873	7·340	8·805
	y	·009	·038	·085	·152	·238	·343
52	x	1·352	2·704	4·055	5·405	6·754	8·103
	y	·009	·037	·083	·149	·232	·335
56	x	1·238	2·456	3·684	4·910	6·136	7·360
	y	·008	·035	·080	·142	·222	·319
60	x	1·098	2·196	3·294	4·391	5·487	6·582
	y	·008	·033	·074	·133	·207	·299

To construct the projection, plot the top and bottom parallels only from the co-ordinates of Table B, with distance apart on the central meridian from the last column of Table A. Join corresponding points by straight lines for the meridians, and divide the meridians equally to obtain points on the intermediate parallels. The table is computed for each four degrees of latitude, to provide for series of sheets bounded by $\pm 4°$, $\pm 12°$, $\pm 20°$, . . . (the series under construction); or alternatively $0°$, $\pm 8°$, $\pm 16°$, $\pm 24°$, . . . , which might be more desirable in other continents. Note that the middle parallel is not plotted from the tables, but constructed as above.

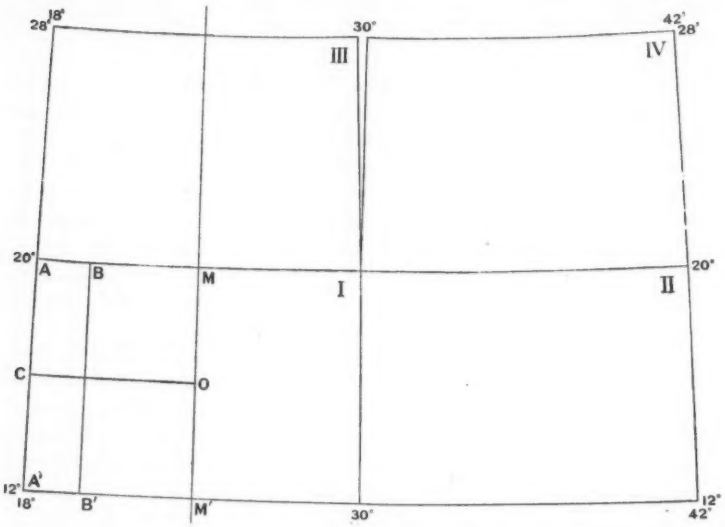
For sheets 12° by 8° the angle between an extreme and the central meridian is given in the following table C; the difference θ between these angles on successive sheets measures the bend of the extreme meridian at the junction of two sheets fitted along a parallel; 2θ is the angle shown in the figure between the inner margins of two sheets of the top row; and $2 \times 17{\cdot}5 \sin \theta$, approximately $0{\cdot}01\theta$ (where θ is in minutes of arc), is the separation in inches at the top inner corner. Finally, the last columns of the table show the shortening of the middle parallel due to making the extreme meridians straight, and the consequent error of scale along this central parallel.

TABLE C.

Lat.		*Inclin. of extreme meridian.*	*Diff.* $= \theta$.	*Separation.*	*Shortening of central parallel.*	*Scale error.*
4° to 12°		51′·2			0·062 in.	·0024
			47′·3	0·48 in.		
12	20	98′·5			·061	·0024
			48′·9	0·50		
20	28	147′·4			·060	·0025
			43′·7	0·45		
28	36	191′·1			·054	·0025
			41′·4	0·42		
36	44	232′·5			·050	·0025
			34′·8	0·35		
44	52	267′·3			·042	·0024
			31′·7	0·32		
52	60	299′·0			·035	·0024

The figure shows the assemblage of four sheets plotted from these tables. Sheet I. between meridians 18° and 30° E. and parallels 12° and 20° N. has length on central meridian 17·382 inches from Table A. The co-ords. of A with respect to M are $x = 12{\cdot}357$, $y = +0{\cdot}221$ inch; and of A′ with respect to M′ are $x = 12{\cdot}862$, $y = +0{\cdot}140$. Other points on the top and bottom parallels, at each degree of longitude, are plotted similarly from Table B. Corresponding points are joined by straight lines, and subdivided equally to obtain the other parallels. The meridian BB′ 8° from the central meridian is its true length. Meridians AA′ and MM′ are respectively long and short

by 0·044 inch (Table A). The meridian AA′ is inclined 98″·5 to AA′; it makes an angle 48″·9 with the prolongation of the same meridian on the sheet above. The extremity C of the central parallel OC is 0·061 inch nearer O than it would have been if each parallel had been plotted independently on the polyconic projection (and the meridians therefore curved). The consequent error of scale on the middle parallel is 0·0024, the extreme parallels being correct. Finally, the separation at the top inner corner of sheets of the top row (near III) is 0·50 inch. All the latter figures are from Table C.



The problem of compiling a General Map of Africa is of course very different from that of the 1/Million maps of Europe, where there was—at any rate in most parts—a superabundance of precise material, and the difficulty was largely in selection. For Africa the material is naturally very heterogeneous. One passes in a few miles from good triangulation and first-class topographical survey to districts hardly explored, where the outline is more than doubtful, and determinations of height altogether inadequate for the construction even of the roughest contours. Scattered all about the continent are patches of good official survey, and there is much material due to private enterprise, as surveys of railways and mining concessions, to the owners of which we are in many cases indebted for the communication of valuable information. The great geodetic arc of the 30th meridian provides a strong backbone from the south to near the southern end of Tanganyika, along the Uganda–Congo boundary, and for some distance up the Nile. The greater part of the remaining framework of the map is provided by the various boundary surveys. Hard things have been said of diplomatists who, in advance of any geographical knowledge of a country, agree to the delimitation of boundaries by meridians,

parallels, and other arbitrary lines. Such boundaries are detestable in principle, and work out badly in practice; but they do, at any rate, require for their demarcation costly triangulations, which would not have been so imperatively necessary had the boundary been defined by well-marked natural features: and these triangulations come in remarkably useful as framework on which to hang inferior material. The essential framework of our map would have been sensibly less rigid had the boundary surveyors not been required to spend so much time on locating the 30th meridian, the meridian of Panta, and other lines famous in the political geography of Africa.

We may illustrate the condition of the material for constructing a General Map of Africa by considering a few cases of important corrections recently made, and of points which remain in dispute. Take first the position of the head of Lake Tanganyika. The foot of the lake was fixed by a boundary commission triangulating from Nyasa in 1898; the head of the lake remained on our maps (German) about 3½ miles wrong in position, until in 1912 the Belgians carried a chain of triangles south and west from the junction of the Anglo–Belgian–German boundary on the summit of Sabinio to the head of Tanganyika and along its western shore, thus rectifying what must surely be the last remaining error of importance on the line of the Great Lakes, and incidentally showing that the accuracy of the German map of their former possession in East Africa, on the scale of 1/300,000, is by no means so great as its frequently detailed appearance should presuppose. A more striking instance is of later date. When the Belgians occupied Tabora they acquired a set of blue prints of a railway survey from Tabora to the bend of the Kagera, to illustrate the line projected by Dr. Schnee, the former governor. This careful survey on the scale of 1/100,000, with heights and form lines, bears little relation to the representation of the country on the 1/300,000 map, which is thus shown to be exceedingly unreliable in its delineation of the complex water system on this ill-defined water-parting between the Nile and the eastern affluents of Tanganyika.

There was until recently much uncertainty in the heights of Tanganyika and Nyasa. The discrepant results for Tanganyika obtained by the hypsometer were used in the 'Text-book of Topographical Surveying' (Close and Cox, 2nd edit., 1913), to illustrate the uncertainty of this method; see page 130, and the comment "It is not known what the true value is." Since that time two good determinations have become available: the railway levels of the Zentralbahn, which make rail-level at Kigoma 773 metres; and the connection with the heights of the geodetic arc, made by the Rhodesia–Congo Boundary Commission, 1913 (Major Walker and Lieut. Gwynn), giving the same number 773 metres for the lake surface. The height of rail at Kigoma above the lake being unknown to us, but probably only a few metres, we adopt the Boundary Commission figure as it stands.

The difference of height between Tanganyika and Nyasa was determined by Close and Boileau in 1898 as 299 metres, which with the above figure for Tanganyika makes Nyasa 474 metres. But the Portuguese Nyasaland Railway levels, kindly communicated by Messrs. Pauling, give 468 metres. We adopt the mean of the two, 471 metres, for the height of Nyasa.

A question which has given us much trouble has been settled recently in a way which leaves it still mysterious. In 1882 Mr. Last was sent on an expedition at the expense of the Society to proceed through Nyasaland to Blantyre. The first article of his instructions was to determine the position of the confluence of the Ruvuma and the Lujenda, its principal affluent on the right bank. He obtained a longitude 38° 1′. This longitude was quoted many years afterwards by Moisel among the somewhat infrequent astronomical determinations of position available as the foundation for the map of German East Africa on the scale of 1/Million; but the longitude in question was plotted upon the map as 38° 30′, without any indication of reason for rejecting the quantity which had been cited in the list of materials. This discordance was of course noted in the compilation of our map, and Last's original observations were examined. They form a very satisfactory set of astronomical positions, based upon a longitude of Lindi on the coast which was in accordance with modern determinations, and ending with a longitude of Blantyre which is equally good. There were two independent determinations of the longitude of the confluence, one of which had not been worked up; it gave results precisely in accordance with that which had been used. It seemed impossible to reject Last's longitude, and one was reduced to such an hypothesis as that the German draughtsman had plotted the value adopted by Moisel with an error of 30′ and adjusted other things to suit. To carry out the necessary readjustment would have made considerable distortions in the existing maps, but it is illustrative of the bad state of survey in those parts that nothing could be found which absolutely negatived the possibility of moving the confluence. It was clearly a case of asking for a redetermination at the earliest possible moment; Colonel Hedley therefore very kindly sent instructions to a field-survey company on service there, and a traverse was run from Lindi to Ngomano at this confluence. The result was to put the confluence a mile still further east than the German map had made it. It appears therefore that the German draughtsman was right in neglecting Last's position, which had been actually inserted in his list of material; but it remains unknown why Moisel printed and published a position which he believed to be so much in error, and it is still more mysterious how Last's observation can be explained. One might suppose that he mistook some other river for the Lujenda, and determined the position of the wrong confluence, were this not negatived by the fact that he afterwards proceeded right up the Lujenda. The whole thing remains very inexplicable.

A difficulty of a somewhat different kind remains in the geography of the western rift valley between Lakes Kivu and Edward, where comparatively recent volcanic activity has thrown up the remarkable volcanoes of the Mfumbiro Mountains, and has, according to geologists, diverted Lake Kivu from the basin of the Nile to that of the Congo. The principal highway between the two lakes runs from the northern end of Kivu between the volcanoes Ninagongo and Karisimbi, and thence north-east to the Belgian post of Ruchuru. On the saddle between the volcanoes the path reaches a height little less than 7000 feet. The question, which is of considerable importance from the point of possible railway construction, is whether an alternative route near the western wall of the rift does not run at a considerably lower level. The region between the western volcano Nyamlagira and the western wall of the rift is very little known. It is just off the maps on the scale of 1/100,000 of the German Lake Kivu Boundary Expedition, and is equally just outside the limits of the map by Oberleutnant Weiss of the volcanic district, published in the scientific results of the Duke of Mecklenburg's Central Africa Expedition, 1907–8: a pretty map, which is however described by a Belgian authority as "une fantaisie." A line of levels run in 1903 by M. Adam, chief engineer of the Congo railways, and reproduced in the *Journal* for November 1908, p. 493, shows a line which seems to run near the western edge of the rift, and its summit level is 7578 feet. On the other hand, Sir Alfred Sharpe, who in 1912 was travelling in this region with Mr. Elphinstone, gives a very different account. He speaks of the lava plain west of Nyamlagira stretching to the foot of the steep mountain slopes bordering the western side of the rift valley, and only 5900 feet above sea. He climbed to a village, Nkule, 1200 feet higher, on the edge overlooking the rift valley, and descended to the Mokoto Lakes, which are at an average of 5800 feet (the only height for these lakes which appears to have been given). Returning again through Nkule and thence down to the rift valley, he steadily descended as he went north towards Lake Edward. Before reaching the Ruchuru he crossed a small river issuing from lava rocks which forms a series of marshes on the western side of the rift valley and enters Lake Edward near its south-west corner. This river does not appear on most of the maps. Sir Alfred Sharpe has kindly gone into the matter with us, and is strongly of the opinion that his observations show a way from Lake Kivu to Lake Edward along the western edge of the rift which does not rise above 5900 feet. Yet the earlier railway survey through the same country took the line 1600 feet higher. The difference between the two accounts is so great that it affects very materially one's idea of the profile of the rift valley and the completeness or otherwise of the volcanic bar across it.

[Since this was written I have had the advantage of discussing the question with Commandant Maury, of the Belgian Colonial Service, who spent some years in the Kivu country. His explanation of the triangulation

chart attached to his publication: 'Les regions voisines de la frontière oriental du Congo belge' (1912), makes it clear that the western wall of the rift is broken very much in the way shown on the *Carte de l'Etat Independent du Congo*, 1/M, 1907, and that Sir Alfred Sharpe's way lies along the face of the eastern spur. It is possible that the railway survey was taken over this spur and down to the valley lying between it and the continuation southward of the main western wall. The relation of the Mokoto Lakes to the rift valley is very obscure, and a particularly interesting piece of country, now no longer very inaccessible, awaits topographical reconnaissance.]

The navigability of rivers is an important and a difficult thing to show on a map of Africa. Excluding canoe navigation, and restricting the term "navigable" to rivers which are available for transport under power, by steamer or motor launch, we are faced with seasonal variations, which can be covered by a warning that navigation may be suspended in the dry season; but we cannot cope with the fluctuations of longer period such as that which has in recent years stopped navigation on the Shire. (See the paper by Sir Alfred Sharpe in the last number, p. 143.) Conventional signs showing navigability must therefore be inserted with caution and interpreted with reserve.

Difficulties of a different kind arise from the mutability of things in Africa. The maps are full of names derived from the journeys of travellers that are no longer recognized by those best acquainted with the country. During the course of our work we have, whenever possible, asked district officers, directors of public works, and other officials, to look over our compilations and advise us as to their adequacy. The result is often disturbing. "Oh yes, that is a wash-out; we used to have a post there, but it was given up as unhealthy ten years ago, and there is nothing there now," is the all too frequent comment. In a small area of the Marsabit sheet (Africa, 1/Million, North A37 and part 38), we learn from the District Commissioner that Lake Karoli is a mere salt-pan, never full; that Daran Kraal is no longer there; that Tumepona means "We are saved," and was the name given to a camp where water was found in the nick of time by a certain traveller; that Pullo does not exist as a name, nor Horr as a place-name, though there is a Horr Valley, and so on. In such cases it is very hard to strike a proper balance between tradition and present local knowledge.

The classification of place-names also offers many problems. The population classification designed for Europe is evidently inapplicable. We may start with a scheme such as Class I., capitals and any towns over 100,000; Class II., capitals of provinces or districts, and any towns over 50,000; Class III., other Government posts, telegraph stations, principal missions; Class IV., smaller mission stations, larger native towns, native markets, etc.; and Class V., smaller native towns; but such a scheme

leaves many problems unsolved.* Lado, for instance, is one of the best-known names in Africa. The seat of administration has been moved to Mongalla, and the place is reported to be quite deserted; how shall the name be classed? Or take Marsabit, the administrative post of the northern province of British East Africa, established some years ago on a forest-covered mountain at the edge of a crater lake. The place has given its name to a sheet of the International Map; but we learn that it was found cold, damp, and disappointing; camels died in the fog of the forest, and the natives hated going there; so the last occupant of the commissioner's house burned it down and the place is deserted, the seat of administration being removed elsewhere; how shall we class the name Marsabit upon the 1/Two Million Map? Such are the mutabilities of the more important names. The changes in native names are infinite, and it is probably near the mark to say that half the native names upon maps no longer represent any centre of native population, and are no longer locally recognized in the country. The map illustrating Joseph Thomson's celebrated journey from Dar-es-Salaam to Nyasa in 1878 shows forty-eight names on his route between the coast and the lake. Of these only nineteen (and two of those doubtful) are on the German 1/300,000 map; and three of the six names in larger type, as chief places of the districts, are not to be found. This is a good reason for being moderate in the use of native names on the map.

If the map is to have a good appearance the names should be distributed in their classes so that the series of numbers in each class makes something like a geometrical progression. A well-classified map of a settled country will be found to follow this rule more or less, though special circumstances may intervene: a tendency to aggregation in a limited number of large towns, as in Australia and Eastern Siberia: an extreme development of an industrial region, producing so many considerable towns that there is no room on the map for the appropriate number of smaller towns and villages: historical importance of places no longer active; and so on. In Africa the criterion of population is secondary

* On this classification Colonel Hedley remarks, in a recent letter, that "references to population are put so high that they do not apply to East Africa at all," and suggests alternatively: Class I., capitals of countries and towns of great importance; Class II., capitals of provinces or large districts, principal military stations, and important towns; Class III., other centres of European population, important mission stations, etc.; Class IV., small European settlements and important native towns; Class V., other native towns.

The only reason for inserting the population figures in our provisional scheme was to provide for such cases as Johannesburg, Alexandria, Durban, which have large populations but are not of high administrative rank, yet are entitled to Class I. The principal requisite in classification is a rule which will promote to higher classes, especially to Class II., places of small population but real importance; and if, in accordance with Colonel Hedley's suggestion, we add "principal military stations" to the schedule for Class II., we shall probably find that few if any places of importance have failed to secure due prominence on the map.

The names which are wanted, and which must be made to stand out, are the centres of administration and of civilized development. The mutability of native villages will be a reason for restricting the number of names assigned to the lowest class. But the principle of a geometric progression offers at any rate a method of comparing and discussing a first classification which will be found useful. We will test it by examining the names on our first compilation of the Zanzibar sheet 1/2M, and compare it with that on the four sheets of a 1/M map covering the same area, compiled to a great extent independently and nearly simultaneously.

The 1/2M map has five classes of names, and the 1/M has six. The names common to the two are distributed thus:

	1/M Class 1	2	3	4	5	6	Total.
1/2M Class 1	3	—	—	—	—	—	3
2	4	9	6	3	—	—	22
3	—	1	20	43	30	7	101
4	—	—	5	95	52	24	176
5	—	—	1	38	116	89	244
Total	7	10	32	179	198	120	546

Such a table forms an excellent check upon the first attempts at compilation. We notice at once (*a*) that Class 3, 1/2M, is unduly big: too many smaller mission stations had been included; (*b*) that Class 5 is disproportionately small: smaller native villages had been somewhat neglected, owing to difficulty of choice; (*c*) that three places classed 4 in 1/M were classed 2 in 1/2M: they were provincial capitals recently elevated, and not hitherto given due rank on the maps; (*d*) that first-class towns were rather common on 1/M; two of them proved to have been promoted unduly as the largest town on the sheet, though not first class.

To control the uniformity of method in selection we may compare the total numbers in each class on adjacent sheets. Thus, taking the four 1/M sheets above, we have the following numbers:

	Sheet I.	*II.*	*III.*	*IV.*
Class 1	5	1	1	0
2	3	4	2	1
3	11	4	7	11
4	36	17	124	56
5	297	164	254	125
6	479	651	635	922
Total	831	841	1023	1115

We note the deficiencies of Classes 3 and 4 on Sheet II.: the excesses of Class 4 on Sheet III. and of Class 6 on Sheet IV. If there are no evident local circumstances (as there very well may be) to justify these departures from a rough geometrical progression, we must reconsider the classification. Such elementary statistics form a valuable means of control, and should not be neglected.

The spelling of native names offers problems which have not, I think, yet received all the discussion which they deserve. The well-known general rules for the spelling of native names published by this Society have obtained wide acceptance, and there is a most valuable little work based upon them ('Rules for the Transliteration of Place-Names occurring on Foreign Maps.' 1906. Official. 1*s*.) by the late Mr. Knox, Map Curator to the G.S.G.S., which is of great value and perhaps hardly sufficiently recognized outside the War Office and those who work for it. The problem which Mr. Knox set himself to solve was this: Native names will be written in different ways by different nations of Europe. Assuming that their methods are consistent, and that they are based upon the normal use of letters to represent sounds occurring in the home languages, it should be possible to construct transliteration tables by which, say, the Portuguese version of a Bantu name may be changed into the English version. A study of the rules given by Mr. Knox will show that he has realized the difficulties and discovered many complexities due to inconsistencies in practice. His work forms an inestimable foundation upon which to build. We have found, however, that the rules given in this work cannot always be trusted to produce the right result automatically. Take, for example, the frontiers of Rhodesia and Mozambique. A strict application of the rules produces a whole crop of names in Portuguese territory beginning with *sh*, which contrasts markedly with an equally numerous crop beginning with *ch* in British territory. The names on the Portuguese side had been written *ch* by the Portuguese; but in accordance with Mr. Knox's rule the *ch* had been changed to *sh*. We consulted Sir Harry Johnston, who replied that "the Portuguese *ch* in African names nearly always stands for our *ch*, even if the perverse Portuguese pronounce it *sh*. As a rule, when very anxious to secure an *sh* pronunciation, they use their *x*, which always connotes *sh*, except when it stands for the *x* in the Latin *ex* prefix. The Bantu, however, wobble very much over the *ch* and *sh*, even in the same tribe or district." And in another place Sir Harry Johnston writes to us: "With great inconsistency the Portuguese *ch* (normally pronounced *sh*) and the Portuguese *j* (*zh*) more usually stand for *ch* and *j* in English. *J* never answers to *y*." Many doubtful points of the kind have been referred to Sir Harry Johnston, and on his authority we are able to propose the following as samples of additions and corrections to Knox's rules for treatment of Portuguese African maps:

1. "*u* before a vowel = *w*" (Knox); but *u* after *l* or *r* and before a vowel should be retained, as in Lualua and Ruenya. Luuia should be transliterated Luwia. There are also certain Bantu county names, like Uamba, Uimbi, in which the *U* stands for an older *Bu*, and is much accented. These *u*'s should be retained.

2. "*Gua* = *gwa* and *gue* = *ge*" (Knox). The Portuguese are very inconsistent. *Gue* may stand for *ge*, but it may also stand for *gwe*.

Punctilious Portuguese spell *gue* or *gwe* as *güe*, but this is rare. Missongue should be Misonge ; but Rungue should be transliterated Rungwe.

3. "*dj* = *j* and *j* = *y*, but *j* (initial) = *hy*" (Knox). As above, Portuguese *j* more usually stands for English *j* in African names. The Bantu passes abruptly from English *j* to *y*, and seldom halts at the French *j*: thus Ujiji varies locally from Udjidji to Uyiyi, the former being the better rendering.

4. "*ch* = *sh* and *tch* = *ch*" (Knox). As above *ch* more usually generally remains *ch*, and the Portuguese rarely use *tch* to represent this sound.

Such are some of the preliminary results of working through the Portuguese Bantu names. It is clear that Mr. Knox's rules, though most valuable, are not water-tight, and cannot be applied mechanically with safety. Probably they represent very accurately what, on the analogy of their speech at home, the Portuguese ought to do with Bantu names if they are consistent.

A curious complication arises in certain cases where the Portuguese have applied to districts names compounded of Bantu and Portuguese, as "Maganja da Costa" and "Maganja aquem Shire," meaning "Coast M." and "M. on this side of Shire." The Portuguese must of course be allowed to stand. If the Portuguese version of Bantu is also allowed to stand, it becomes inconsistent with other names on the map, and very possibly with the same name used as a place-name. The only solution appears to be to transliterate the Bantu parts of these names in the same way as the others.

A somewhat analogous difficulty arises in the treatment of geographical terms. The War Office rule, following that of the R.G.S., is that geographical terms will be translated either into English or into the recognized local language. Thus, Bahia de Msimboa and Bahia da Fernão Velloso would become Mzimbwa Bay and Fernão Velloso Bay. The rules of the International Map, London Conference, 1909, provide that "The spelling of every place-name in a colony, protectorate, or possession shall be that adopted by the country governing the colony, protectorate, or possession, if that country uses the Latin alphabet, or publishes other maps in which the place-names are printed in the Latin alphabet." This would not only seem to require that geographical terms should be left in the language of the governing power, but also would prohibit the transliteration of which we have been speaking above. The East African sheets published by the War Office break the rules in both respects. It seems absolutely necessary to break it on the question of the transliteration of native names, but it is not so clear that the geographical terms should be translated into English. It is not done, for example, in the Istambul sheet, where we have capes as Burun, bays as Keurfezi, etc., and there are certain advantages in leaving these terms in the language of the ruling power. A curious feature of this Portuguese East African

coast is that most of the capes are called "Ras," retaining apparently their Arab names. Arabic words corrupted by Bantu and transliterated *viâ* German or Portuguese need some discrimination.

Somewhat analogous difficulties arise in the treatment of German Bantu names, especially since the Germans have no letter corresponding to the English *w*, which is so common in African names. The consequence is that they are apt to use the *w* indiscriminately for the sound of *v* and of *w*, and it is impossible without local knowledge to be certain that the names are correctly represented on our maps. Some further complication is caused by the fact that on the maps of the Usambara region the Germans deliberately broke further away from their own methods and adopted the English system, but not always with success. If a draughtsman working by rule inadvertently applies to these names a second reduction to the English system, the result may be disastrous.

Mr. Knox has written a long and valuable note on these problems of the German African maps, which we may supplement by a more tabular examination of the subject. The principal maps of German Africa are, with our abbreviations :

Karte von Deutsch-Oostafrika, 1/300,000	G/3
Grosser Deutcher Kolonialatlas : Sprigade and Moisel	Gdk.
Kiepert's Deutscher Kolonialatlas	K.
Perthes' Deutscher Kolonialatlas	P.
Usambara und Küstengebiet (Govt. of G.E.A.) ...	U.

The following examples are arranged in groups to show how some of the principal sounds in which there is difficulty are treated by the various German authorities. The spellings adopted on our 1/2M map have been submitted to Sir Harry Johnston, and on his authority we have made the doubtful distinctions between *w* and *u*.

1. *Sound of English* v.

Gdk.	Kiwu	Kiwmangao	Rowuma	Kiwindsche
K.	Kivo	Kivumangao	Rovuma	Kivindje
G/3	Kivu	Kiwmangao	Rowuma	Kiwindje
P.	Kiwu	Kifmangao	Ruwuma	Kiwindsche
1/2M	Kivu	Kivmangao	Rovuma	Kivinje

2. *Sound of English* w.

Gdk.	Mpapua	Muansa	Tschwaka	Bwaua	Kilwa
K.	Mpwapwa	Mwansa	Tshuaka	—	Kilwa
G/3	Mpapwa	Mwansa	Tshuaka	Bwaua	Kilwa
P.	Mpapua	Muansa	Tschuaka	—	Kiloa
1/2M	Mpwapwa	Mwanza	Chwaka	Bwawa	Kilwa

These examples show that the German *w* is used somewhat indiscriminately for *v* and *w*, and that Kiepert and Perthes are perhaps more

consistent than Gdk. or G/3. In the *w* sound there must be room for difference of opinion whether the *u* is really consonantal = *w* or is a distinct but very short vowel. When it is apparently distinct German maps often show the distinction by putting the diæresis over the second vowel, or by accenting the *u*; and one would expect that in such cases the *u* is not transliterated *w*. We have, however, Usambara: Lwengera, but Gdk. Luëngesa, so that even this is not a safe guide.

3. *Sound of English* y.

Gdk.	Tanganjika	Ejassi	Bagamojo	Jassin
K.	Tanganyika	Eiaši	Bagamoyo	—
G/3	Tanganjika	Eyassi	Bagamoyo	—
P.	Tanganjika	—	Bagamojo	Jassin
1/2M	Tanganyika	Eyasi	Bagamoyo	Yasin

In the last, an Arabic name, Usambara has Jasin, contrary to its principles.

4. *Sound of English* j.

Gdk.	Udjidji	Kissidju	Mawudji	Kilimandscharo
K.	Udjidji	Kišiyu	Mavudji	Kilima-Ndjaro
G/3	Udjidji	Kissidyu	Mawudyi	Kilimandscharo
P.	Udschidschi	Kissidschu	Mawudschi	Kilima-Ndscharo
1/2 M	Ujiji	Kisiju	Mavuji	Kilimanjaro

The second and third examples show the tendency for this sound to vary from English *j* to *y* (as recorded by Sir Harry Johnston), but this does not explain the *dy*. On the 1/2M map we use the English *j* (as in the R.G.S. rules) for Bantu names, though this is not consistent with the rule we adopted on the 1/M map for the same sound in Arabic. The sound of French *j* or *zh* being unknown in Bantu, and the English *j* very common and thoroughly established in the English spelling of such names as Ujiji, it seemed difficult to insist on a rendering which would have given a very German appearance to the map.

5. *Sound of English* ch.

Gdk.	Tschaki	Tschole	Kondutschi	Tschurui
K.	Tshaka (Tshak-tschak)	Shole	Kondutṣhi	
G/3	Chaki	Tshole	Kondutshi	Tschurui
P.	Tschaki	Tschole	Kondutshi	[U. Churui]
1/2M	Chake	Chole	Konduchi	Churui

6. *Sound of English* sh.

Gdk.	Moschi	Aruscha	Maschëui
K.	Modji	Arusha	—
G/3	Moschi	Aruscha	Mschihui
P.	Moschi	Aruscha	[U. Mshihui]
1/2M	Moshi	Arusha	Mshihui

7. *Sound of English* s (as in set).

Gdk.	Njassa	Kissegesse	Kisserawe	Sakare	
K.	Nyasa	Kisigesi	Kiserawa	—	
G/3	Njassa	Kissegesse	Kisserawe	Sakare	Msassa
P.	Njassa	—	Kisserawe	[U. Sakarre]	[U. Msasa]
1/2M	Nyasa	Kisegese	Kiserawe	Sakarre	Msasa

8. *Sound of English* z

Gdk	Sansibar	Msimbasi	Russisi	Masinde
K.	Sansibar	—	—	—
G/3	Sansibar	—	Russisi	Masinde
P.	Sansibar	[U. Msembazi]	Russisi	[U. Mazinde]
1/2M	Zanzibar	Msimbazi	Rusizi	Mazinde

These examples show that though as a general rule

German tsch = English ch
sch sh
ss s
s z

there are many inconsistencies in the hearing or representation of sounds, and transliteration by rule is a balance of probabilities. The publication by the Government of G. E. A. of the Usambara map marked a considerable step in advance, recognizing the unsuitability of the usual German equivalents for sounds in the Bantu languages, as in the name Mtschorotschogoro; unfortunately the principle was not extended to the rest of the country.

Such are some of the difficulties which must arise from the divergence of tongues in which African names have been written. We cannot hope to avoid mistakes, but we do look forward to the time when there shall be a Board of Geographic Names for Africa, which shall standardize them to some extent before inconsistencies have become "conventional" and therefore sacred: *e.g.* Khartoum and Sudan.

To all who have helped and are helping in the preparation of this map our grateful acknowledgments are due. Much unpublished material has been placed in our hands, both from official and non-official sources, which will be acknowledged as far as possible in the list of Authorities for each sheet. The ladies and gentlemen who form our special war-staff have worked enthusiastically; we are especially indebted to those who have been able to volunteer their services, and scarcely less to those who have worked devotedly on a minimum of pay.

Before the paper the PRESIDENT said: Our Secretary has devoted much time and attention to our compilation of a new map of Africa. Nobody could be more competent than he to tell us the methods which he has followed, and I trust that, amongst other things, he will tell us with all due candour exactly what he thinks of the value of the material on which he worked.

(*Mr. Hinks then read the paper printed above, and a discussion followed.*)

The PRESIDENT: I should like to begin the discussion by saying a word on map compilation. Having been for a great many years at the head of a map-compiling office, I have, no doubt, some crystallized ideas on the subject; and it is exceedingly interesting to me to see how methods change, and in some ways improve, in the matter of compilation. The compilation of this map of Africa is very analogous to the compilation of the frontier maps of India; both have to deal with a large amount of diverse material, some of it doubtful, some absolutely bad, and some of it really based on sound survey. But there was this distinction between the work out there that I have had to deal with and this African map, that in India there was no possibility of delay. A map might be made in the course of one month, and expected to be in the hands of Government the next. Examination and correlation of all the material must be condensed into a few days, or at most a few weeks. There are three distinct classes of work: First the more or less regular survey carried out during the progress of a campaign or expedition into new country; secondly, the endless amount of work derived from the political business of settling boundaries, generally speaking based on tolerably sound foundations; and finally, the work of explorers who succeed in getting beyond the limits the professional surveyors can reach, and who bring back work of varying value which is often a very great trouble to the compilers. The difficulty arises from the fact that a traveller who goes over country which he thinks to be new, believes absolutely in his own work and will give very little credit to what has gone before. Travellers often go into the field misinformed, or only half informed, as to what has gone before them; they may entirely overlook an existing strong backbone of triangulation on which to work. And they constantly criticize the work of others where they happen to touch it, though they do not know their own position. I do not want to give you another lecture on the subject, but it would be very easy to enlarge the discussion into several hours over the matter of map-compilation. I will just call your attention to some work that has come into our compilations in India. The first is a little map of the military position at Dargai on the Afghan frontier. An action was fought there which has been very much misrepresented, and while that action was being fought a native surveyor made the map; there are about 25 or 30 square miles of it, and that was his day's work. At the end of the day he had to sit down and by the light of the camp-fire make a fair drawing of it. Next morning he had to produce a tracing which by means of some sun-printing process could be printed off. That was in the hands of the general who commanded the force by the evening of the day after the action had taken place; and after the military authorities had put on the face of the map their views—probably traced in red—as to the particular lines on which each column acted, and the details of the day's action, the map was sent in to headquarters. Such a map had to be done literally in two days. I have another fine piece of work which carries a certain lesson with it. I always regard it as a specimen of the way in which, under military exigencies in the field, work ought to be done in a hilly country. The work was done by Captain Robertson. While he got in all the information necessary for military purposes, he carefully left all details of hill drawing for subsequent elaboration. Captain Robertson was the officer who assisted me so greatly in the Andes on the boundary between the Argentine and Chile. He carried that class of survey from the north of Tierra del Fuego to Lake Buenos Aires, some 400 or 500 miles, in the course of two seasons; on that the boundary was determined.

Major WOLFF, D.S.O.: Mr. Hinks mentioned that it was proposed to make one sheet of the new map correspond to four sheets of the 1/M map. Might I ask what rule will be adopted for numbering those sheets. It seems to me that a very suitable nomenclature would be A, B, 32, 33; and so on.

Dr. J. W. EVANS: Might I ask whether Mr. Hinks has noted that a number of Portuguese and possibly Brazilian place-names have been imported into Africa. I notice in the reproduction of a table from Mr. Knox's book that there are two names evidently Brazilian, Japura and Ceara, one a well-known Brazilian river and the other a town. We do the same thing in our own colonies, and I should suggest that one would naturally retain those names as being thoroughly Portuguese.

Mr. HINKS: There are a number of purely Portuguese names on the map—for example, Pundanhar—and some of which it is difficult to say whether they are Portuguese or not. I am glad to have Dr. Evans' suggestion that some are Brazilian. Ceara did not look to me like a Bantu name; it is evidently a mistake to include it in a transliteration table.

Captain OGILVIE: I should like to say how glad I am to see this map-work being done on regions for which we have never had any reliable maps on these scales. For two reasons it gives me pleasure: first, because in providing maps for the army one is constantly feeling the lack of full small-scale strategical maps on which the relief of the country is well shown; and secondly, because in teaching geography a decent map of Africa on that scale is most useful.

Major LANGTON: I came here this afternoon to see some of the valuable work which the Royal Geographical Society is doing. I do not think we all quite appreciate how much work is done by private individuals as well as by the Government. Many are working and giving their time and knowledge to helping the various departments in this matter, and my particular department will be very much indebted to the Royal Geographical Society for this map of Africa.

Mr. A. E. YOUNG: Mr. Hinks was kind enough to refer to the projection which I calculated for this map: I am much obliged to him for giving me this work to do, because I found it very interesting, and it led me to examine the whole subject and to get some results which I think were interesting and useful. It is a technical subject and difficult to explain verbally, so I will not trouble the meeting very much with it; I hope to publish some of the results later on. But with regard to the projection for this map of Africa, the International Map projection, I found that up to a very considerable longitude from the central meridian this polyconic projection is practically the same as Cassini's projection; the longitude scale only differed by 2 per cent. But Cassini's projection is cylindrical, and only a particular case of a conical projection. It will improve a conical projection by making two parallels standard. That is similar to what M. Lallemand did. He took the error of the extreme east and west line meridians and gave half to the central meridian. You can either make the error over the whole map as small as possible, or make the maximum error as small as possible. M. Lallemand adopted Tissot's criterion, and I do not know whether he knew that he reduced the maximum error by fifty per cent. by this small correction. For myself, I think Airy's criterion the better. You get a rather larger maximum error, but a small average error.

Mr. MCCAW: I am afraid if I were to deal with all the matters that interest me I should detain you very much too long. I was greatly interested in the map dealing with the great volcanic region on the south of Lake Edward, and should like to ask whether the change to which Mr. Hinks has referred at

the south of Lake Edward has altered to any extent the previous course of the Kagera River, which we have always accepted as the extreme source of the Nile, rising from along the borders of Lake Tanganyika. The lakes on the other side of Tanganyika are remarkable. From one of the stations which I occupied I counted no less than twenty-two, all lying like punch-bowls just round about the station, with a rim of sulphurous deposit round them. All surveyors have had great trouble with place-names. It is a subject which leads to endless discussion, and I shall refer only to one small point: the *ch* which in Portuguese appears sometimes as *sh*. In moving up from Northern Rhodesia I have never found that *sh* pronounced otherwise than as the *ch* in *church*. It is so common a prefix to Bantu words that I think we may take it that is really the proper sound. It is used in a most extraordinary way, frequently meaning "sir" or "great." For example, a Bantu is not accustomed to a water-carrier as big as one of our buckets, and consequently when he is provided with a bucket he considers it a very large article which deserves a special name. Therefore, in order to honour it he puts *ch* in front of its name.

Mr. REEVES: This is a very important map, and one that was greatly needed; the old French map was altogether out of date. But apart from that there is no complete map of Africa on anything like a sufficiently large scale to be of use. The weighing of the material for a map of this sort is a most serious question. It ranges from first-rate triangulations such as we have of Algeria, Tunis, Egypt, and parts of East Africa, to stuff really not worth calling mapping at all. It is, of course, very difficult to appraise the material. I think we have done the best we can, but one feels that it is not very satisfactory in all parts. The question with regard to Mr. Last's Survey has rather shaken one's confidence in what one has always considered quite reliable traverses. Here is a man who starts off after a good long training, with good instruments, and after he has got only 120 miles he makes an error, apparently, in longitude of something like 30 miles in an astronomical position. We want some way of mapping, or some supplement to the map, to convey an idea of the value of the material in each part. It is a difficult thing to show on a map itself. You want some sort of a handbook accompanying the map, so that people who have to map later on can see what reliance has been placed on material.

Mr. HINKS: Major Wolff asked a very pertinent question. There is no doubt that we should put upon the margin of the map the numbers of the 1/M sheets which it covers. We should at the corner of the map covering sheets A 32 and 33, Bt32 and 33 write A, B, 32, 33. But I think we must give each sheet a name as well. We find we have some sixty sheets of the 1/M map of Europe. The numbering of the sheets does not provide a ready means of reference, and in the 1/M map each sheet had to be named by the principal town in it. In a much larger sheet, such as British East Africa, there is sometimes a difficulty about calling it by the name of any particular town, and we have adopted names such as Congo Forest, Limpopo, or Chad. I think it will be found that those are the names that will really be convenient for reference to the sheets, although they will have their 1/M numbers also. Mr. Young gave us a foretaste of what I hope will turn out a most interesting paper which he will some day read at one of the afternoon meetings. The result of my having asked him two years ago to compute this projection has been most happy. He got thoroughly interested in the subject, and in the course of his investigations has produced a number of perfectly new results which have thrown a great flood of light upon the whole question and will, I believe, be a contribution to the

subject of first-rate importance. It has come out very markedly in help he has more recently given me for the 1/5M map of Asia, a much more difficult question. I should like to emphasize my appreciation of the very great services Mr. Young has rendered. Mr. McCaw's question, whether volcanic change could have affected the source of the Kagera, I am unable to answer. I am not sure whether any competent geologist has been to the source of the Kagera; it is rather east of the parts affected by the great volcanic outburst in the western rift. However, if it is true that Lake Kivu used to be in the Nile system, then clearly the volcanic outburst has affected the source of the Nile very materially, although not at the particular point Mr. McCaw mentioned. In closing, I should like to express my thanks to those who have spoken all too appreciatively of the work we have been trying to do here, and also to call attention to the fact that we are for the first time making a serious attempt to produce a layer-coloured map of Africa upon an adequate scale. We cannot expect to get contours at close intervals because the parts sufficiently well surveyed are very slight; but we have tried to make contours at intervals of 500 metres, and when they are layer-coloured you do get a representation that is beginning to be satisfactory of what is, I think, the most interesting country in the whole world, the lake region and the two rift valleys of Central Africa.

GEOLOGICAL INTERPRETATIONS OF GEODETIC RESULTS: A CRITICAL EXAMINATION OF MR. R. D. OLDHAM'S RECENT TREATISE ON HIMALAYAN STRUCTURE

Sir Sidney Burrard, F.R.S., Surveyor-General of India

THE alluvial plains of the Ganges conceal from our view a deep "trough" that has been formed in the Earth's crust. The "trough" is bounded on the north by the Himalayan Mountains and on the south by an ancient tableland. This "trough" was called by Suess the Himalayan Foredeep; its origin and its relationship to the mountains are among the unsolved problems of geology and geophysics.

For many years the Trigonometrical Survey of India has been taking geodetic observations over both hills and plains: it has determined the direction and the intensity of gravity at numerous places. During its operations its chiefs have frequently had the benefit of consultation with foreign delegates at International Geodetic Conferences, and with successive directors of the Geological Survey of India. The gap between geology and geodesy is, however, difficult to bridge: the students of the two branches of science have been differently trained, and the best hope of future progress lies in personal collaboration.

Mr. R. D. Oldham, F.R.S., has lately published a memoir ('Memoirs, Geological Survey of India,' vol. 42, part 2, 1917) entitled "The Structure of the Himalayas, and of the Gangetic Plain, as elucidated by Geodetic Observations in India."

When a book on Geodesy is written by a professional geologist it

starts on its career with the keen interest of geodesists. But Mr. Oldham's treatise will do nothing towards bridging the gap; its attempts to lower the standard of geodetic accuracy will be resented. As a book it is difficult to follow; for though its language is that of positive assertion, its meanings are frequently obscure. Individual sentences may be strongly worded, yet in the aggregate their collective meaning is uncertain.

In his geodetic calculations Mr. Oldham's first step is to discard the Himalaya Mountains of nature and to substitute for them an "Imaginary Range," the dimensions and contour of which he has designed; he says that the method of geodesy is too laborious. He therefore decides to ignore "the complicated contour of the actual Himalayas." He also assumes in his calculations that his imaginary range has an east and west direction, whereas the true Himalaya extend over 7° of latitude.

Mr. Oldham tries to show that his imaginary range is similar to the true Himalaya in its powers of attraction. The safest way of making such a comparison would be to test the attraction of the imaginary mountains *uncompensated* against the attraction of the true mountains *uncompensated*. But this test is not faced; both the imaginary and the true mountains are assumed to be wholly compensated by underlying deficiencies of matter, and the resultant attractions are thus reduced to small quantities. The attraction of a mountain mass causes deflections of the plumb-line, but if the mass be assumed wholly compensated by underlying deficiencies of matter, its positive attraction will become nullified by the negative attraction, and the deflections will tend to vanish. The deflection of the plumb-line caused at the station of Kaliana by the positive attraction of the true Himalaya is 58″; that caused by the imaginary range is 6″. The discrepancy is no less than 52″, but by taking compensation into account, Mr. Oldham reduces the Himalayan effect from 58″ to 3″, and the effect of his imaginary range from 6″ to 2″ (p. 42). He then compares 3″ with 2″ and argues that a discrepancy of 1″ is admissible.

If we are dealing with a large deflection such as 58″, a discrepancy of 1″ denotes an error less than 2 per cent. But when a large deflection has been reduced by compensation to 3″ a discrepancy of 1″ denotes an error of 33 per cent. Mr. Oldham states that the attraction of the imaginary range (compensated) exceeds that of the true range at all stations, but there are mistakes in his computations (Table 5). At Lambatach in the mountains the effect of the imaginary range (compensated) is 55 per cent. *larger* than that of the true range: whilst at Kaliana, 41 miles distant from the foot of the mountains, the effect of the imaginary range is 33 per cent. *smaller* than that of the true range; errors such as these prove that the imaginary range is not suitable for geodetic investigations.

It is true that when Mr. Oldham first introduces his imaginary range (p. 36) he excuses it on the grounds that it is intended for the preliminary

stages and not for the final calculations of the investigation. But he fails to adhere to this stipulation: at the end of his book he arrives at final and positive conclusions concerning the compensation of the Himalaya Mountains (pp. 112, 114), and he claims to have discovered the form of the underground floor of the whole Gangetic trough (p. 119); these conclusions are all based on the imaginary range.

We use the word "trough" for want of a better. The word conveys the idea of a long rock hollow filled with loose alluvium. But at moderate depths alluvium becomes compacted into solid rock: and at greater depths it may become metamorphosed. Mr. Oldham describes the Gangetic "trough" as though it were a simple depression in the rock-surface filled with alluvium, and as though the alluvium were 16,000 feet deep (pp. 7, 8 *et seq.*). This value of the depth is obtained from Middlemiss's measurements of exposed strata at the foot of the Himalaya in Kumaun, north-east of Delhi ('Geological Survey of India,' vol. 24, p. 29). But Middlemiss shows that these strata are built up of the following thicknesses :—

	Feet.
Siwalik conglomerate	3000
Sand-rock	8000
Sandstone	6000

Thus the trough is not a rock-basin containing loose alluvium; it is a basin constructed of ancient rocks in which Tertiary rocks have been consolidated. The dividing line between the northern wall and its solid contents can be discovered only by a geologist. Geodesists have used the word "trough" to denote the crustal zone throughout which the rock is of lower density than normal; and they take the depth of the trough to be the depth to which deficiency of density extends, independently of the kind or age of the rocks involved.

We have now to consider this problem: If the sides and floor of a trough have been formed of ancient rocks, and if its contents consist of Tertiary rocks, can a pendulum be utilized to determine the depth of the lowest Tertiary rocks?

If at any place a pendulum is observed to be swinging at a slower rate than normal, a deficiency of rock in the underlying crust is indicated; whereas if a pendulum is observed to oscillate rapidly, the inference is warranted that the underlying crust is unusually dense. These variations in the rate of swing at different places signify variations in the force of gravity, and constitute what are known as local "gravity anomalies." Wherever a gravity anomaly is observed to be negative, the crust is abnormally light, and wherever a gravity anomaly is positive the crust is dense.

An excess or defect of matter may be near the surface of the crust, or it may be hidden at a great depth. Geodesists have met with difficulties in dealing with this problem of depth: they can prove the existence of an

excess of matter in the crust, but they are unable to determine whether the excess is superficial or deep.* Observations have shown that the density of the crust is different in different regions, and varies from place to place, and that these unceasing variations extend downwards to great depths (perhaps 70 miles).

If a pendulum station is situated above the light Tertiary rocks of the Gangetic trough, the gravity anomaly will have a tendency to be negative. But the deeper rocks will affect the pendulum also : and if they are unduly light they will *accentuate* the negative tendency, whereas if they are dense, they will *counteract* that tendency. A gravity anomaly is due to both surface and deep-seated rocks, and the difficulty is to disentangle their respective effects. By means of a sounding-line we can discover the depth of water, and by boring we may discover the depth of alluvium, but a pendulum is not a sounding nor a boring instrument, and observations of gravity do not determine depths of sea or alluvium.

I do not contend that a pendulum can never be used to determine the depth of a particular rock. I will give an instance in which I think it might be so utilized. The Mysore Gold Mines are situated in a small patch of heavy rock (Dharwar schist, density 3·00) which is lying in a surface hollow of the Mysore plateau (gneiss, density 2·67). The patch of heavy rock containing the gold is only 4 miles wide ; if pendulum observations on the gneiss surrounding the patch give a constant gravity anomaly, and if the anomaly at once becomes larger at stations on the patch, the increase in the intensity of gravity may be fairly attributed to the excessive density of the patch. No complete investigation has yet been made, but Lenox-Conyngham found that the gravity anomaly on the patch was 0·034 greater than at Bangalore (Professional Paper 15, p. 24, Survey of India) : he has calculated that this anomaly would denote a depth of about 13,500 feet for the heavy schist of the patch. The gold-mining operations have now reached a depth of 5000 feet. The reason, which would justify us in this case in attributing the increase in the gravity anomaly to the patch, would be that the pendulum stations on and off the patch being so near together (*i.e.* within 2 to 3 miles) the cause of the increase would appear to be local.

The Gangetic alluvium presents a different problem : its area is great and we cannot attribute anomalies to any local cause such as the lightness of alluvium. The geodetic observations have led us to believe that the Earth's crust north of the alluvium is deficient in density to a great depth, and that south of the alluvium the density of the crust is excessive. Under the Himalaya the density of the crust is below normal : south of the trough there is a zone of excessive density known as the "hidden range" (p. 124). The junction of the two different densities occurs in the crust underlying the alluvium.

* See the writer's paper on the Gangetic Trough, *Proc. Royal Society*, A, vol. 91, pp. 230, 233.

Mr. Oldham considers that the depth of the trough is about 16,000 feet at the northern edge and that it gradually decreases from north to south (pp. 82, 119). All gravity anomalies that can be made to fit this hypothesis he interprets as due to the lightness of alluvium. But anomalies that do not fit he interprets as due to deep-seated rocks *below* the alluvium. On p. 81 he writes of the station Monghyr: "Though situated close to the southern edge of the alluvium it gives a Bouguer anomaly of −0·031, and a Hayford of −0·024 dyne, and, as it is difficult to believe that there can be a thickness of over 4000 feet of alluvium under this station, we must fall back on the supposition that the anomaly is due to a more deep-seated deficiency of density. A similar, though smaller defect of density at the station of Sasaram, suggests that in both cases the anomaly may be due to a deep-seated defect of density in the rocks below the alluvium."

The fact that the anomalies at Monghyr and Sasaram have to be rejected as untrustworthy measures of the depth of surface alluvium raises the question, What security is there that other anomalies give reliable measures? There is no security; a gravity anomaly is a measure of the density of the Earth's crust, and not of the uppermost layer only.

If the gravity anomalies at alluvial stations were wholly due to the lightness of surface alluvium, they would everywhere be negative; but at several stations on the alluvium the gravity anomalies are positive. On p. 81, Mr. Oldham writes of two stations on the alluvium at which gravity is in excess: "The high positive anomaly at Kisnapur is evidently the result of a deep-seated excess of density in the rock underlying the alluvium, but its magnitude, and the smaller positive anomaly at Chatra, show that the alluvium cannot have any great thickness, comparable to that in the Gangetic trough, for if there were any great thickness of alluvium the negative effect of the defect in density would more largely neutralize the deep-seated excess of density in one case, and in the other would make the anomaly negative, instead of positive." This argument is incorrect; the positive anomalies merely show that there is an excess of matter in the crust, notwithstanding the surface alluvium; they furnish no evidence as to the depth of alluvium.

The gravity anomaly at Mian Mir on the alluvium is +0·040 dyne, showing that gravity is in excess. On p. 85, Mr. Oldham writes: "The positive anomaly at Mian Mir shows that the alluvium cannot have any great thickness here." The positive anomaly at Mian Mir merely denotes that the lightness of the surface alluvium is more than counterbalanced by the density of the deeper rock: it is no proof that the alluvium is shallow.

To illustrate the risks of using gravity anomalies as measures of depth, I will refer to Hecker's observations of gravity over the ocean.* When Hecker was vertically over the Tonga Deep he found that the deficiency

* 'Gravity Determinations on the Ocean.' Berlin, 1910. Hecker assumed the ocean to be isostatically compensated.

of gravity was −0·245 dyne. If Hecker had adopted Mr. Oldham's method, he would have deduced the depth of the Tonga Deep to be 13,300 feet; the sounding lead showed that the true depth was 27,800 feet. When Hecker's steamer crossed the Tonga plateau, he found that the gravity anomaly was +0·264 dyne. If then he had used the argument that a positive anomaly denotes shallow depth, he would have concluded that the Tonga plateau could not be far below the surface of the sea. The soundings showed that it was 8800 feet deep.

If an observation for gravity is taken over the ocean, the presence of water can be allowed for as its density is known. But the density of alluvium when compressed and compacted at moderate and great depths is an uncertain quantity. Mr. Oldham has assumed the average density of the Gangetic alluvium from the surface to a depth of 4 miles to be 2·16. The rock-walls of the trough have a density of 2·67, and he assumes that the contents of the deep trough have a density of 20 per cent. less than the rock walls.

General Sorsbie, author of *Geology for Engineers*, estimates that the mean density of the Gangetic deposits, loose and solid, shallow and deep, would be about 2·4. Mr. Hunter has determined the density of exposed Siwalik sandstone at Hurdwar and Mohan, and has found it vary from 2·35 to 2·60, and these specimens were broken from weathered scarps and were possibly less compact than when buried and compressed by the weight of miles of superincumbent strata. He has determined the density of khankar (carbonate of lime) dug from the surface of the alluvial plains, and has found it to average 2·34. Barrell in his investigations of the Strength of the Earth's Crust assumes 2·5 as the density of the deposits of the Nile and the Niger (*Journal of Geology*, 22, p. 43).

There are thus reasons for doubting whether Mr. Oldham's assumption of density = 2·16 is justifiable, and it will be useful to show the effects upon his results if a density-value of 2·4 be substituted.

Station. (See pp. 84 and 90.)	Distance from northern edge of trough in miles.	Depth of alluvium as deduced from gravity anomaly.	
		Density 2·16 according to Oldham.	If density 2·4 be substituted.
Rajpore	0	15,000	30,000
Dehra Dun	2	12,000	24,000
Roorkee	25	13,000	26,000
Nojli	38	12,000	24,000
Pathankot	1	23,000	46,000

Mr. Oldham claims (pp. 91, 119) that his geodetic values of depth *at the northern edge* of the plains agree with the geological value, namely

16,000 feet. My table shows that his claim can be established only if an unduly low density is assumed for the alluvium. The adoption of the density 2·4 produces a great discrepancy between the so-called geodetic and geological values. It must not be supposed that I am putting forward the depths in the last columns of these tables as probably correct: they are, I think, based on more reasonable assumptions than the figures in the third columns, but the lesson they teach is that the method adopted of deducing depths of surface alluvium from gravity anomalies is unreliable. The magnitudes of the quantities in the last column support the view that the negative anomalies over the Gangetic trough are partly due to the attenuation of the rock that is *below* the Tertiary deposits.

On p. 119, Mr. Oldham writes: "We have also found complete confirmation of the geological deduction that the depth of the alluvium along the outer edge of the Himalayas is great, amounting to about 15,000 to 20,000 feet towards the northern boundary of the alluvial plain, figures which are in complete accord with those deduced from the geological examination of the Siwalik hills. This agreement, between the results of two wholly independent and different lines of research, leaves little room for doubt that we have reached a correct interpretation of the underground form of the Gangetic trough from near its northern limit to the southern boundary, and that its maximum depth is about 15,000 to 20,000 feet, possibly more on some sections, probably less on others, but in most cases lying within the limits named."

In this summary Mr. Oldham claims to have discovered the underground form of the Gangetic trough from north to south, and from east to west. The average width of the trough from north to south is 150 miles; its length from east to west is 1000 miles: it occupies an area of 150,000 square miles. Mr. Oldham claims to have interpreted the underground form of this great alluvial area by means of the "agreement between the results of two wholly independent and different lines of research."

Let us consider upon what grounds these claims are based. The geological deduction from exposed strata is that the depth of the trough *at one point* near its northern edge is 16,000 feet (p. 6); there is no geological evidence of depth east or west of this point, and there is no geological evidence anywhere as to the maximum depth of the trough, or as to the distance from the edge at which the maximum depth occurs (p. 8). The geological "line of research" is thus limited to *one point* in a trough 1000 miles long and 150 miles broad. Certain geodetic results can be brought into approximate agreement with this one geological deduction by the adoption of a particular value of surface density.

But even the alleged agreement itself "between the two wholly independent lines of research" is not clearly indicated. The geological deduction was made in the foothills of Kumaun south of the Ganges,

where no geodetic stations exist; in the foothills just north of the Ganges there are two geodetic stations, Rajpore and Dehra Dun. In order to confirm Mr. Oldham's geological conjecture that deep alluvium exists under Rajpore and Dehra Dun, negative anomalies were required (p. 107), and these were obtained by the aid of the Imaginary Range (p. 90). But the anomalies as calculated by the Trigonometrical Survey are positive, and this result has placed Mr. Oldham in a predicament (p. 91). He writes that "these stations cannot be used with any degree of safety in determining the form of the trough." Thus the agreement between the different lines of research can only be maintained if two of the most important geodetic results are excluded from the investigation.

From 1866 to 1870 Captain Basevi observed the pendulum at several places in India; he was a careful observer, but in his day no method had been devised of determining the sway of the pendulum stand. When a pendulum is swinging its stand is swayed by it, and this swaying tends to increase the time of the pendulum's oscillation; consequently if no correction is applied, the deduced value of gravity will be too small; the greater the "flexure" of the stand the greater the error in the observed result. For his observations in India Basevi used a heavy braced stand. In 1870 he decided to swing his pendulums at a high altitude in Ladak, and in order to lighten his loads and to facilitate transport he introduced a special light stand. This light stand he used in his observations at the Indian Station of Mian Mir, and he then transported it across the Himalaya Mountains to the station of Moré (height 15,427 feet). In Ladak he died, and it is not known what became of the light pendulum stand.

In 1903 Colonel Lenox-Conyngham commenced his modern series of pendulum observations, and during his first tour he visited four of Basevi's stations. His observations gave larger values of g than Basevi had obtained, the discrepancies varying from 0·027 at Bombay to 0·044 at Madras and to 0·103 at Dehra Dun. These discrepancies were attributed by Lenox-Conyngham to the omission of the "flexure correction" by Basevi (Survey of India, 'Narrative Reports,' 1903–04, para. 139). Other stations of Basevi's were visited in subsequent years. In 1906 Lenox-Conyngham observed at the station of Mian Mir where Basevi had used his special light stand; at this station the discrepancy between the old and the new results was 0·112.

Basevi's pendulum observations have thus been superseded; they served their purpose well, and their supersession is the inevitable fate of all observations which have been rendered obsolete by modern instrumental improvements. His more important stations have been revisited and their results revised. Eighteen of Basevi's stations have not as yet been revisited by modern observers, but in their stead 108 new pendulum stations have been established in India. If it had not been

for the war, the station of Moré would have been revisited by a British observer in 1915 or 1916. Commander Alessio of the Filippi expedition (1913) endeavoured to observe the pendulum at Moré, but the attempt had to be made too early in the year and was frustrated by heavy snow.

Basevi's results were included in Helmert's compilations for the International Geodetic Association. After Lenox-Conyngham had completed his observations at Mian Mir, the International Association in 1909 deduced from them a "flexure correction" for Moré. Helmert was constructing a formula that would give the normal value of gravity in any latitude, and the Association wished to show how this formula agreed with observed results. The Association did not intend to convey to geologists the idea that they would now be justified in building far-reaching theories upon the Moré result.

Unfortunately Professor Borrass, who compiled the report, made the mistake of assuming that Basevi's light stand had been used at *two* stations in India, and that its flexure correction had remained *the same* at both places ('Report, 16th International Geodetic Conference,' 1911, p. 236). He thought that the light stand had been used at Dehra Dun as well as at Mian Mir and Moré. Believing that Dehra Dun and Mian Mir should be classed together and finding that the two corrections were accordant, he adopted a mean correction and applied it at Moré. Borrass stated his flexure corrections as follows:—

Deduced at Dehra Dun	+0·103
Deduced at Mian Mir	+0·112
Mean	+0·107 ±0·004

At Dehra Dun the pendulum had been swung on the heavy stand and at Mian Mir on the light one. The agreement between the corrections deduced by Borrass was fortuitous; Borrass's mean value and his probable error being based on misapprehension have thus no weight.

In September 1916 an article by Mr. Oldham on Basevi's pendulum observations appeared in the *Geographical Journal*, in which the author expressed the opinion that the flexure correction for Basevi's results could be estimated. This had already been done, but such an estimate cannot be made with sufficient accuracy. It is a question of the standard of accuracy required. Basevi omitted the flexure correction, and nothing now can raise his results to the modern standard of accuracy. The flexure of Basevi's heavy stand was apt to vary from station to station, and even the modern stand shows variations of flexure sufficiently great to necessitate a redetermination whenever the apparatus is re-erected. As to the behaviour of Basevi's light stand we know but one fact, namely, that his Mian Mir result requires a correction of +0·112.

Mr. Oldham assumes that Basevi's flexure correction was the same at Moré as at Mian Mir. Basevi recorded that at Mian Mir the stand was

erected on a "floor of solid paka masonry": at Moré he recorded that the soil was "very loose and sandy." Between Mian Mir and Moré the stand had to be carried on men's backs for hundreds of miles over high mountains and passes: at Moré the stand was exposed to conditions of temperature, pressure, humidity, and wind totally different from those of Mian Mir.

When Mr. Oldham's article appeared I did not understand its purport. No one had been criticizing Basevi, and his pendulum results were being replaced and extended by the modern series. In his memoir Mr. Oldham supplies a reason for his article. He wished to use Basevi's result at Moré in support of a new theory, and he now feels enabled to state (p. 110), that the Moré results having been discredited have been reinstated. As this vague statement may be taken to mean that responsible authorities have reconsidered their opinion about Moré, I may perhaps explain that by "reinstatement" Mr. Oldham means the article he wrote himself in the *Geographical Journal*.

In his memoir (p. 111) Mr. Oldham estimates the anomaly for Moré as −0·434, and compares it with Borrass's result −0·433, published in 1911. He writes: "The two values of anomaly differ by only 0·001 dyne, and we may take it that the deficiency at Moré is not far from 0·43 dyne." It is hardly necessary for me to point out that the agreement of these two results is no evidence of accuracy. These two results are both derived by the same method from the same observation.

Mr. Oldham's new theory seems to be based upon the anomaly at Moré, namely, −0·434; this is certainly a large negative value, but all anomalies at high altitudes, if deduced on Bouguer's hypothesis, have negative values. Bouguer's hypothesis was that mountains were being supported by the rigidity of the crust. It has been recognized for many years that isostatic compensation must be taken into account, and Hayford's method based on the theory of isostasy has now superseded Bouguer's. The substitution of the theory of isostasy for that of extreme rigidity has had the effect of converting the negative anomalies which formerly obtained at high Himalayan altitudes into positive anomalies.

Instead of deducing the Hayford anomaly by clear steps, Mr. Oldham mixes in the same paragraph two geodetic hypotheses (Bouguer and Hayford) and two systems of mountains, the imaginary and the real (p. 111); and then out of this obscurity he draws the conclusion that "in the Central Himalaya compensation is in the excess" (pp. 112, 114). Having produced no evidence, he writes: "It is evident that the defect of composition has disappeared" (p. 112).

One assumption leads to another, and his next step is to assume that as the compensation is in excess at Moré, the whole extensive mountain area of the inner and higher Himalayas must be over-compensated, buoyant and light. (It might be just as fairly assumed that the gravity

anomaly observed at Geneva is applicable to the whole area of Pyrenees, Alps and Carpathians.)

Finally, Mr. Oldham proceeds to the further assumptions that as this great Himalayan area is buoyant, it must be rising (p. 115); that the Earth's crust is being uplifted here by its buoyancy, and that owing to its uplift the crust to the south is being tilted downwards and is creating the Gangetic trough (p. 123). In this way his reinstatement of the Moré result has led up to his theory of the origin of the Gangetic trough.

The Trigonometrical Survey of India has benefited in the past from the collaboration of men who were not professional geodesists, notably, Archdeacon Pratt and Osmond Fisher. These distinguished investigators were endeavouring to utilize the geodetic data for unravelling the secrets of Nature. The welcome that was extended to them was awaiting Mr. Oldham; but his attitude towards geodesy has been different. He has considered it admissible to alter scientific data and to create new data from imaginary ranges. In the same table (pp. 77 and 90) he combines true geodetic data with figures of his own, and an uninitiated reader will never realize that the quantities given under the heading of "Hayford compensation" have not been deduced by Hayford's method.

Mr. Oldham's reference to the Aravalli Mountains is equally inaccurate. This range traverses Rajputana in a north-easterly direction, and terminates near Delhi as a small ridge which is an insignificant topographical feature. Mr. Oldham recalls a geological suggestion made many years ago that this range may once have extended across the Gangetic trough into the Himalaya. He now quotes the deflections of the plumb-line at three stations as evidence in support of this suggestion (p. 97). Two of these deflections however furnish no evidence on the point, whilst the evidence of the third (Sarkara) is adverse. Any reader can check my criticism by examining the map attached to the memoir. If the Aravalli axis is produced it will pass north-west of Sarkara; this will not diminish the northerly deflection at Sarkara. Yet Mr. Oldham sums up as follows: "The geological structure has suggested the possibility of an original extension of the Aravalli range into what is now the Himalayan region; the geodetic observations have supported this suggestion and converted what was only a bare possibility into something more than a probability."

So mistaken indeed are Mr. Oldham's ideas of geodetic principles and accuracy, that when he found his calculation of the depth of the alluvium at Agra was not in accord with the depth obtained by boring, he attributed the disagreement not to his own hypothesis but to the geodetic data (p. 80). He avoided this disagreement not by reconsidering his own assumptions, but by altering the observed results. On p. 112 he says he found it "necessary to apply a correction of $-0{\cdot}02$ dyne" to the pendulum results as the latter did not give the depth of the alluvium

correctly: and he even suggested that this Agra correction might be applied to Basevi's observations at Moré. The scientific precautions taken in the observation of pendulums become useless if the results, obtained by labour and care, are to be treated as they are in this memoir.

LETTER FROM MR. STEFÁNSSON

[We have much pleasure in publishing the following letter from Mr. Stefánsson, written on 20 July 1918 from St. Stephen's Hospital, Fort Yukon, Alaska. In a covering letter Mr. Stefánsson gives the excellent news that although he does not expect to be quite well for several months, he has sufficiently recovered from his long illness to be able to undertake a lecture tour on behalf of the funds of the Red Cross, beginning at New York on October 6 under the auspices of the American Geographical Society and the American Museum of Natural History.—Ed. *G. J.*]

I HAVE recently seen in your *Journal* for February and May of the current year two short references to the work of the Canadian Arctic Expedition. They are as correct as the news sources on which you had to draw admitted.

The impression that I had arrived at Fort Yukon last Christmas was based on the newspaper assumption that I was myself present at the telegraph station from which my messages were sent to the Government and others. I had, however, sent them from the vicinity of Herschel Island by a south-bound trader whose vessel, the *El Sueno*, had been frozen in at Herschel. This was Captain Alexander Allan, who during 1915–16 was connected with the southern wing of our expedition.

It was correctly announced by Dr. Anderson (as you have it in your February note) that my intention was to have the *Polar Bear* attempt to proceed in 1916 from her base near Amstrong Point, Victoria Island, to winter on South Melville Island. She was then to continue south in 1917 by the well-known eastern route. I gave the appropriate orders to the *Polar Bear*, but, during my absence in our new islands north of Melville Island in the summer of 1916, they were not carried out, and the vessel in fact proceeded about 100 miles south, and wintered near Collinson's old quarters in Walker Bay. The reason for her doing so cannot be entered into here. In the summer of 1917 the *Polar Bear* sailed for the mainland before our spring exploring party had time to get south to her. The members of our sledge exploring parties of the springs 1916 and 1917 saw neither the *Polar Bear* nor any other vessel from midwinter of 1915–16 till September 1917. Seventeen of us spent the winter 1916–17 in Melville Island on Liddon Gulf and at Cape Grassy. Our houses were musk-ox hide, our fuel was locally discovered coal, our food

reindeer and musk-ox meat, and our light musk-ox fat and seal oil. For the spring sledge provisions, to replace pemmican and other typical Arctic rations, we used dried meat and musk-ox fat with complete satisfaction. We did not visit the Kellett-McClintock cache at Dealy Island until on our way home in July 1917. The Bernier cache at Winter Harbour had some iron for sled shoeing, kerosene for our primus stoves (not enough), and canvas and similar articles that were very useful to us. The food cached there, however, injured us as much as the hardware helped—two of the three men mainly employed by us in visiting this cache and repairing sleighs there got scurvy as a result of eating the food. Fortunately the third man was an Eskimo whose taste for fresh meat saved him from the ill fortune of the two white men, who confined themselves pretty well to the Bernier provisions whenever they had a chance.

Your readers may or may not be interested in a narrative of our movements, which, in any case, I am not now in a position to make public. A summary of certain of our results may be of interest to geographers.

In this summary the work of the southern section of the expedition is omitted, as some of its results have been published (in summary), and I do not know which ones. I have not for three years received mail till this spring, and there has not yet been time for the arrival from Ottawa of mail, the notification of the sending of which has come by telegraph.

In the discovery of new land and the mapping of previously unvisited coasts the following has been accomplished:

The coastline of Prince Patrick Island between the "farthests" of McClintock and Mecham was completed in June 1915.

The coastline of Victoria Island between the "farthests" of Wynniatt (McClure) and Hansen (Amundsen) was completed before Christmas 1915, and in July 1916 by parties under Storkersen (former mate of the *Duchess of Bedford*). An island 20 or more miles long was also discovered in Melville Sound, near north-east Victoria Island.

The coastlines of Emerald Isle and Fitzwilliam Owen Islands (of McClintock) were completed in 1915 and 1916.

Both shores of Hassel Sound were rectified in 1916. That strait is of an average width of over 15 miles, and at the narrowest is about 15. It was noted by one of our parties under Aarnaut Castel in 1916, and also by my own party in 1916 and again in 1917, that Isachsen Land appears to be an island separated from Ellef Ringnes Island by a strait of which Dronning Louise Fjord and Dyrebugten of Isachsen (Sverdrup) are parts. As we did not actually traverse the straits we cannot be certain, but no land connection was seen either from north or south.

The hypothetical connection of Isachsen's "King Christian Island" and "Finlay Land" (as shown, *e.g.*, on Admiralty Chart 2118) proves unwarranted. The south tip of King Christian Island is in 77° 41′ N. lat.,

and it is about 15 miles long east and west. The south point of Finlay Island is about 77° 6′ N. lat., and the island is about 12 miles in its greatest diameter, and between 600 and 700 feet high. It is probable that Osborne's "two remarkable formations" on Finlay Island are the higher part of Finlay Island itself and a second island about 3 miles long that lies between Finlay and Paterson Islands. We ran a line of soundings between King Christian and Finlay Islands (as we usually do in crossing any sea), and found 172 fathoms the greatest depth.

The things given in the preceding paragraph were noted in July and August 1916. On August 3 we discovered a new island with an average width of 12 miles and a long axis running about north-north-west. Its south tip is in 77° 9′ N. lat. and its northern in 77° 55′. The respective longitudes are 107° and 108° 10′ W. On this island we spent the month of August, for the water on top of the sea-ice had become disagreeably deep, and we feared a break-up (which did not occur). Here we got good observations for time as much as twenty-seven days apart. The rate of our watches proved to be satisfactory. The summer of 1917 we succeeded in "tying up" this observation spot with Parry Rock, Melville Island (Winter Harbour).

As the location of the larger of our new islands has already been published, I shall only note here that their outer edges lie roughly on a great circle drawn through the most projecting points of the north-west coasts of Grant Land and Prince Patrick Island, and that they go well towards filling the gaps between Prince Patrick and Ringnes Islands on one side and Ringnes and Heiberg Islands on the other.

In sea soundings the following has been done: In 1914 a line of soundings was run from the Alaskan coast northward between meridians 141 and 142 W. to about 73° N., and thence north-east, east, and south-east to Norway Island (Banks Island), going at the highest a little north of 74°. North of Alaska the continental slope is of a steep and probably nearly uniform "grade"; west of Banks Island it has three well-marked terraces between the depths of 1200 and 200 metres. In each case the continental edge is between 40 and 50 miles from shore. The continental slope once passed, we never got bottom with a 1386-metre line. Originally we had over 3000 metres of wire, but we lost over half of it at our first sounding. After the loss of the *Karluk* we had only some 900 metres of nine-strand wire that we were fortunate in securing from Mr. Leffingwell's cache at Flaxman Island. Had he not given us this we should have had to depend on piano wire, which we have not found satisfactory for such work as ours. (The 3000 metres of wire mentioned above was piano wire, all but the 900 metres secured from Mr. Leffingwell.)

In 1915 we found the continental slope west of Land's End, Prince Patrick Island, to resemble in character and distance from shore that west of northern Banks Island. McClure Strait between Capes Alfred and Land's End is under 500 metres in depth. It deepens more abruptly

away from Cape Alfred than from Land's End. The sea between our first islands and Melville Island is about 200 metres deep along the line which touches on the way Emerald Isle and Fitzwilliam Owen Island. At our more easterly crossings of this sea we could take no soundings, for the season was winter, the ice palæocrystic, and the seal-holes that are so convenient in spring were not then available.

As I remember it (my notes are not at hand) the sea north-east from Cape Isachsen to our second island is under 300 metres, and so it is between the south-east corner of the second island and Amund Ringnes Island. Hassel Sound is under 50 metres, and the sea between Ellef Ringnes and King Christian Island is about 300 metres. Melville Sound deepens abruptly away from both Melville and Victoria Islands at Capes Providence and Peel, and for the main part of the distance has a depth around 450 metres, with slight elevations and depressions.

From the point of view of speculations as to possible undiscovered land in the sea to the north-west, our soundings of the spring 1917 are perhaps the most interesting our expedition has secured. North of Alaska, Leffingwell-Mikkelsen at one point and we at another had found a steep continental slope about 40 or 50 miles from shore; west of Banks Island and west of Prince Patrick Island we had found a slope beginning about the same distance from shore, but differing in being terraced and more gradual. But here in travelling about 140 miles north-north-west from Cape Mamen we found no such slope, but on the other hand a sea-bottom resembling in a remarkable way the bottom of Melville Sound. Off Cape Mamen, at the shore floe some 15 miles from land the depth was 462 metres; 25 miles from Cape Mamen it was 456, and 35 miles off shore it was 444 metres. There was no strong current to make these sounding values doubtful. After this the soundings gradually deepened till 75 miles from shore, where they were 570 metres. Then they shallowed again till near 80½° N. lat. and 111° W. long. we had 502 metres. At this point we were most unfortunately compelled to turn back by the serious illness of two of my three companions.

An outline of the soundings taken by the *Karluk* has already been published by Captain R. A. Bartlett in his 'Last Voyage of the *Karluk*.' *

As to prevailing ocean currents at the surface we have learnt several things. While the drift of the *Karluk* from Camden Bay, Alaska, to the vicinity of Wrangell Island has confirmed the finding by Leffingwell and Mikkelsen of a westward drift north of Alaska *near shore*, our observations show that 200 miles north of Alaska (at least during the time we were there) there appears a tendency of the ice to move in an opposite direction —towards the east. West of Banks and Prince Patrick Island in 1914 and 1915 we found a strong current to the south or south-west—apparently about as strong as the Alaska coast current east of Barrow is to the west. West and north of our new islands in 1916 and 1917 we saw no evidence

* Boston, U.S.A., 1916. Small, Maynard & Co.

of a current in any direction. Our instrumental and sounding observations were in this respect confirmed by the palæocrystic (or permanently little-moving) ice and the consequent scarcity of seals and absence of bears (for where ice-movement does not provide open water these animals are bound to be rare). In all the enclosed seas observed by us, excepting Melville Sound, there are strong currents alternating with the tides, but no other currents that we could detect. The prevailing current in Melville Sound seems to be to the east. Of course this only confirms what was already known and believed about Melville Sound.

In saying there is no evidence as yet to show a prevailing current to the north-west of our new islands, I mean to refer to ice-movement only, and not to the movement of the water underneath. West of Prince Patrick Island we found that when the water was moving north-east the ice remained nearly stationary, but when the current was running south-west under the ice the ice moved with its comparative freedom.

Tide observations were taken as follows: At our Cape Kellett base Mr. Wilkins in the winter of 1914–15 took regular tide-observations for more than a month, and Messrs. Storkersen and Baur for a week of that time took synchronized observations on the west coast 30 miles farther north. In 1915–16 the *Polar Bear* took for three months ten-minute observations in Prince of Wales Strait near Armstrong Point. In 1916, at Cape Isachsen, in Hassel Sound, and at the south tip of our third island (near Finlay Island), we took ten-minute observations for about thirty hours at each place. Local time was secured by the sextant at each observation spot at the time of tide observation.

After the *Karluk* sank, no self-recording tide or current instruments remained to us except those in use by our southern section.

As convincingly indicated by the size and trend of snowdrifts, the prevailing wind north of Isachsen Land is N. or N. by W.; the next strongest about S. by E. In the vicinity of Finlay Island the main winds are N.W. and S.E. (roughly). Around Banks and Victoria Islands the snowdrifts are less easy to read, showing a greater inconstancy of wind directions. On the sea west of Banks Island the prevailing wind is N.W. so far as we could judge.

We took frequent azimuth observations. Several places showed local magnetic disturbance. The most pronounced of these is in Southern Banks Island west of Nelson Head (near Cape Lambton). This might easily be a source of danger to whaling or trading ships in thick weather. Our ship's compass was entirely unreliable in passing the locality a mile off shore.

Raised beaches, sea-shells on the land, and other evidences show that all our new islands as well as the Ringnes Islands are rising. Elevated driftwood may indicate that the west coast of Banks Island has begun recently to rise, but drowned creek-valleys and an embayed coast show more forcibly that there has been a sinking in times not geologically

remote. The rest of Banks Island is probably rising, and there is evidence for a rise of Melville Island.

Musk-oxen are now extinct in Banks Island, though McClure found them abundant. They are still found in Melville Island, and there are some left along the northern coast of Victoria Island. The reason for the extinction of these animals in Banks Island is that on the discovery by the Eskimos of the *Investigator* and the cache in Mercy Bay, Banks Island became a summer resort for the Eskimos of Victoria Island, who supplied thence not only their own needs in iron, but also those of their more easterly and southerly neighbours with whom they traded. This brought to Banks Island several hundred Eskimos each year, whose camps (generally near piles of musk-ox bones) we have found in every corner of the island as well as throughout its interior.

There do not seem to have ever been musk-oxen in any of the islands discovered by us, nor in the Ringnes Islands. Of Prince Patrick Island we know little, for we only followed its west coast, which we found barren and lifeless as Mecham did before us. (While on that coast we had to live on seals exclusively, animals which escaped Mecham's notice because he was unfamiliar with the methods of hunting them according to the season.)

All lands visited by us have reindeer in considerable number, so that an experienced hunter has little trouble in feeding men and dogs as the exploration goes on. To this rule the only exception is our second island (between Isachsen Land and Heiberg Island). We found very little there for food except Hutchins geese; it is the most nearly barren land we have seen.

Polar bears are absent, even to their tracks, from all seas traversed by us north of Land's End, and from all the lands touching that sea. They are found in abundance, however, in southern Hassel Sound, around Finlay Island, along the east coast and on the south coast of Melville Island, and on Southern Prince Patrick Island. Seals are plentiful enough in all seas traversed by us except only north of our new islands, and even here they are plentiful in the shore lead and absent at sea apparently because of the immobility of the ice and its ancient character (and not because of the high latitude).

The above summary does not cover all departments of investigation of the northern section of our expedition [*e.g.* archæology, ethnology, zoology (apart from game animals), etc.], and, as said above, it has no relation to the work of our southern branch; nor does it pretend to be complete even as a summary of the departments treated. The intention is merely to epitomize certain of the results most likely to interest geographers and thus to forecast what future reports of work done may be expected to show.

There is no use in attempting prophecy regarding the results Storkersen's present work will achieve. When an accidental running aground of the *Polar Bear* frustrated our attempt to get to the Pacific Ocean in

1917, and compelled us (because of the late season at which the vessel was eventually floated safely) to winter at Barter Island, Alaska, I at once determined to make the best of the situation by attempting once more to reach the unexplored area of the ocean to the north. Preparations were complete for a start by the full moon of February when, on 9 January, I was overtaken by typhoid fever at Herschel Island. The severity of the disease prevented my sending out reports and letters by the Mounted Police mail which left the Mackenzie delta (Fort Macpherson) in February. The command of the advance ice party had, for the same reason, to be taken over by Storkensen. This necessitated a partial change of plan.

The plan for the work under my own charge had been to go with as much equipment as convenient about 200 miles north from Cross Island, Alaska. Near that distance from shore we would select a suitable cake of palæocrystic ice for a camp site. All supernumerary men and dogs would be sent back to Alaska from here, while four or five of us with two sled and twelve dogs camped on the solid cake. As the camp drifted about during the summer, sextant observations for position would be continuously taken, along with soundings (for which we now had abundant wire, left us by our southern section when they quitted the Arctic in 1916) and other observations. Meantime seal and bear meat would be gradually accumulated, and blubber for light and fuel. After spending the winter on the ice we expected to start in February (probably) 1919, for the nearest suitable landing-place.

I shall not enter here into the feasibility of this plan except to say that it was the result of three years of experience on mobile Arctic ice.

Had the above plan been carried out, Storkersen would have been a member of the party. However, when during my illness he had to undertake the command, the plan was changed (for adequate reasons into which we shall not enter). He had a free hand as to the route chosen and the manner and time of returning to a known land. I rather expected he would go north and then west about 100 miles outside the *Karluk* track (drift), landing in Wrangell Island if he could not easily reach Siberia. As we already know Wrangell Island to be well supplied with game and driftwood (in comparison with the islands in which we have been working), he could with safety have spent the winter there, proceeding to Siberia in the spring 1919, though we expected to have him picked up should any vessel go near Wrangell Island. But it seems Storkersen preferred to attempt landing to the eastward (in one of our new islands or in Banks or Prince Patrick Island according to circumstances). This plan has the obvious disadvantage that adverse currents, if accompanied by open water, may drift him into the area already explored by us, though he doubtless hopes to keep entirely outside of it. The last I heard from him, he hopes to land on some eastern land and to reach Cape Kellett late in August—in time to be picked up there either by the Hudson's Bay Company's ship *Macpherson* or by H. Liebes Company's ship *Herman*.

Arrangements looking toward this end have been made with the Hudson's Bay Company's representative at Herschel Island, Mr. C. Harding, and with Captain C. T. Pedersen of the *Herman*.

To the writing of the foregoing I was prompted by your references to our expedition in the *Journal* for February of this year. In the May number, p. 338, you are in doubt as to the circumstances of my illness at Herschel Island and Inspector Tupper's statement as to it. Inspector Tupper was in charge of that post of the Royal North-West Mounted Police at the beginning of my illness, but he left the district during the time I was sick, and the command passed to Inspector J. W. Phillips. During the three months of my confinement to bed by a succession of typhoid, pneumonia, and pleurisy I received many kindnesses from Inspector Phillips. The men and dogs of our expedition were at this time off on the ice with Storkersen, and it was Inspector Phillips who arranged for my being taken in a sled to the nearest hospital (St. Stephen's, maintained by the Episcopal Church at Fort Yukon, which place is in charge of the well-known traveller and mountaineer, Archdeacon Hudson Stuck). I arrived at Fort Yukon April 27. The journey itself, contrary to expectations, had done me much good, and with the good food and careful attendance of the hospital I am now as nearly recovered as can be expected after so protracted an illness. The present plan is that I shall proceed towards Nome in about two weeks to meet the *Polar Bear*, now under command of Captain John Hadley, one of the men who once was on the *Karluk*. The *Polar Bear*, with good luck, may be in Nome late in August, but, if Storkersen adhered to his plans, his party will not be on her, though it is hoped he will get out by the *Herman* in September.

On pp. 238–241 of the Am. Geog. Society's *Geographical Review* for March 1918 may be found a sufficiently accurate (for my present purpose) statement of the latitudes and longitudes of salient points of our larger islands. All my diaries and records of every sort are on the *Polar Bear* still in the Arctic, except that I have with me an annotated circumpolar chart. The plottings on it were hastily done, so I can cite from it no figures beyond those given above. I cannot vouch for the exact correctness of the figures given by the *Review*, but they cannot be far out.

VILHJÁLMUR STEFÁNSSON.

AFTER-WAR BOUNDARY MAKING

Boundaries in Europe and the Near East. By Colonel Sir Thomas H. Holdich, K.C.M.G., K.C.I.E., C.B. London: Macmillan & Co. 1918. Pp. xii. and 224. *Price 8s. 6d. net.*

SIR Thomas Holdich has done a welcome service in boldly facing the critical problem of the reconstruction of boundaries in Europe and the Near East which must inevitably follow the world-wide war. "Experience,"

he states, "has taught me that most of the trouble that arises out of boundary disputes and their subsequent settlement is due to quite elementary geographical ignorance." In the outlining of new boundaries he has based his views on two main principles—firstly, of harmonizing results with the will of the people concerned, and secondly, of the acquisition of strong scientific frontiers. Sir Thomas Holdich's practical experience in boundary-making in Asia and South America is well known. It is evident from the present volume that he has taken infinite pains to master the geography of the vast region with which he has to deal, including the whole of Europe and a great part of Asia; he often writes as if he had been over the whole ground himself, which of course he has not. As an accomplished geographer he knows how to make the best use of the best maps.

Sir Thomas places no value on rivers as defensive frontiers; the ocean and mountain ranges are the only frontiers worth considering from this point of view. As a soldier and student of human nature he evidently believes that in the future as in the past nations will constantly have to be prepared for possible attacks from their neighbours. He evidently does not believe that the much talked-of League of Nations could do anything to convert this attitude into one of universal fraternity, under which national boundaries would place no obstacle in the way of free intercourse. We may hope that the time will come when "Man to man the world over, Shall brithers be and a' that," but even if in the present struggle Right is victorious over Might, it is to be feared that happy time will not yet have dawned on the world. However this may be, and however much the views of Sir Thomas Holdich may be liable to criticism on other matters with which he deals, the value of the service he has done in blocking out a scheme of delimitation for the consideration of those who will have to deal with the problem is in no way diminished.

Sir Thomas, like others who have written on the subject, has had to deal with such terms as race, nation, nationality, patriotism, and on the whole he has refrained from confusing the significance of the terms.* The terms "race" and "nation" are being constantly confounded. Probably no nation in the world is free from an admixture of race; the United States of America is a conglomeration of nearly all races, and yet its sentiment of nationality is as strong as that of Norway or even the Jugo-Slavs, and no doubt has been emphasized by its entry into the great struggle. Nationality or patriotism is something more than a race feeling. But according to Sir Thomas Holdich it is not community of race or religion, of culture or even patriotism alone that makes a nation to stand as a bulwark of peace in the world; "absolute unity in right sentiment is the first qualification, unity in ideals such as we find in that most eminent admixture of races, the United States of America." If such a unity of sentiment is possible in so heterogeneous a mixture as that of the United States, a territory as large as Europe, it becomes a question whether such unity is not capable of much wider extension. But that is too great a problem to be discussed here. But whatever be the racial constitution of a nation, Sir Thomas Holdich's main object is to indicate what he believes to be the best boundary by which to delimit it from its neighbours. In doing so he says, "The first principle is the obvious necessity for dividing self-governing states or nations into separate geographical units in such manner as to set

* There is a statement on p. 11 which is puzzling. Speaking of Ireland he says, "The antagonism of Gael and Kelt is intensified by the narrow limits of the island in which both are held up." What is the distinction between Gael and Kelt; and where does Ulster come in?

definite and scientific barriers between countries liable to mutual aggression. This principle he specially applies to the Balkans and Western Asia.

In his first chapter, "The Near East," he discusses in detail the various and well-marked geographical features, mountains, rivers, means of communication, etc., as well as race, which ought to be taken into account in delimiting the various states. He maintains that on the broad features of the geography of the Balkan States their history and their destinies are written. His sketch of the history of the various states will doubtless be welcome to many readers. The discussion of the claims advanced by Italy Sir Thomas Holdich admits is beset with difficulties. Her claims against Austria on the one hand, and her demands to have a substantial footing on the eastern coast of the Adriatic are fully discussed. The latter demand is full of complications in relation to the aspirations of Serbia and other Balkan States. If Italy realizes her aspirations and secures the valley of the Isonzo and the Istrian promontory, together with the ports of Trieste and Fiume and certain points of vantage on the long littoral strip of Dalmatian territory, and the islands near it, part at least of a great geographical barrier interposed between the Teutonic Empire and the Ægean Sea will be realized. Her claim to a protectorate of Albania is a knotty point.

Two of the most interesting chapters are those on the Czechs and the Slovaks and on a Jugo-Slav Federation. In the former the author discusses the possibility of forming a Czecho-Slovak state including Bohemia, where the Czechs form the bulk of the population (surrounded by Germans), while the Slovaks extend from the March River through Northern Hungary to the Carpathians ("the new Bohemia"). This suggested state would be separated from the southern Slavs (Croats and Serbs) by Eastern Austria and Hungary. This new state would have well-defined geographical limits, but, as Sir Thomas Holdich shows, its formation is beset with difficulties which it would be hard to overcome. The author discusses very fully the possibility of forming a Jugo-Slav nationality. "With Slovenes, Croats, and Serbians united in the bonds of state federation, they would surely form a nationality strong enough to claim first rank among the powers of Middle Europe—powerful enough to face any possible Germanic combination." This we understand would include the Slovenes in the Austrian provinces of Styria, Carniola, Carinthia, Goritza-Gradiska, Istria, and possibly the basin of the Isonzo. On this Italy would have something to say. Beyond the Slovenes, reaching south-east to Albania, Greece and the Ægean, including all the Adriatic coast north of Albania, are Dalmatians, Montenegrins, Croats, and Serbs, constituting the chief elements of the Jugo-Slav confederation. Jugo-Slavia, the author states, would thus extend from the northern rim of the Save river-basin and the valley of the Danube to the southern borders of Serbia. Here the Slav element amounts to 90 per cent. of the population. The total area would be at least 75,000 square miles, about two-thirds the size of Italy. Within the area would be a Slav population of some 52,000,000. But, the author admits, it is obviously beyond the powers of any international political convention that may be formed after the war to assure the Jugo-Slavs the whole of that great territory in which they claim a majority of the population. This suggests the question whether it would not be an advantage for an approximately pure race to have an intermixture of other types. The author describes the physical features of the great area involved that would be of defensive and economical value to the suggested new state, and discusses the probable attitudes of the various States to be included in the federation, and the border states whose interests and aspirations might be affected.

In the chapter on Bulgaria, which contains a fairly full sketch of its history, Sir Thomas is inclined to deal tenderly with that state (as much Hun as Slav), which he contends has been badly used in the past. "The Bulgar," he states, "is neither better nor worse than his neighbours, and Bulgaria is bound from her geographical position to be powerful in any Balkan Coalition. Therefore it seems better in our own interests that Bulgaria should be strong and friendly, . . . although her antagonism during the War may bar the way to the fulfilment of her aspirations."

Rumania, the author points out, exceeds in extent the area of any other Balkan State. He gives a useful summary of its interesting history, and an analysis of the mixed elements of its population. Transylvania, he points out is naturally claimed as the original home of the Rumanian race. Nevertheless he maintains that the earlier sweep across the mountains into Hungary undertaken by Rumania as an effective demonstration of her objective in joining the War was little less than disastrous, and that her present frontier in the mountain ranges of the Transylvanian Alps and Hungary is preferable to any extended region. The author discusses in some detail the hydrography of Rumania, a remarkable feature of which is its regularity.

Sir Thomas Holdich appears to sympathize with those who are of opinion that Albania, for the present at least, should in her own interests be under the tutelage and protection of a stronger state, without necessarily sacrificing the spirit of national independence. As to Greece the author is of opinion that several readjustments are desirable, both in the interests of Greece and her neighbours. Serbia ought to have a port on the Ægean ; in fact, she ought to have the whole of the valley of the Vardar, practically the whole of Macedonia. This of course would be anything but welcome to Greece, and as compensation she might be offered Crete and the Turkish province of Adrianople. Sir Thomas evidently does not favour any concession on the coast of Asia Minor.

Of Poland Sir Thomas says, that its history and its destiny are written on the face of the land. "Probably no country in the world illustrates more forcibly the disastrous effects of bad boundaries than does Poland." She has been the victim from the earliest times of the intrusion and acquisitions of her neighbours, until at last she was divided among them. The author has little doubt that the end of the War will see Poland restored as a protected (if not independent) state, and the point at issue is whether Germany or Russia is to guarantee the protection. In either case he doubts whether there will be any great shifting of boundaries either in the East or the West. But, he adds, the only logical conclusion is that the end of the War will see Poland transferred from Russia to Germany as a quasi-independent protectorate, unless the Western Allies are in a position to interfere.

The chapter on Russia, as might be expected, deals with many far-reaching problems, entering right into the heart of Asia on the north and to India on the south. Russia, Sir Thomas maintains, is, and must remain, a dominant factor in the making of future history in the Near and Middle East. He deals in some detail with the various problems to be faced by Russia when the time arrives for the reconstruction of the world after the War, and seems to doubt whether a pure democracy would be able to solve them ; under such a *régime* the whole empire might fall to pieces, and among other results the Central Asian provinces become independent. The chapter contains many useful suggestions as to the extension of railway construction east and south-east through Persia, and on to Baluchistan and the Indian border.

In the chapter on Turkey Sir Thomas seems on the whole to favour the expulsion of the Turk from Europe, and if this is done Thrace might be handed over to Greece in exchange for concessions elsewhere. As, he maintains, there are only 6,000,000 Turks among the 20,000,000 population of the Turkish empire, it is clear that to shift Turkey definitely out of Europe is not such a drastic proceeding as might have been anticipated. In considering what part of Turkey-in-Asia should be allotted to the Turk, Sir Thomas would detach Syria, and takes it as a foregone conclusion the Frenchman will take his place in Palestine. The Hidjaz and Mesopotamia must also go. This means that the Ottoman would have to return to the land of his earliest occupation after he left the steppes of Central Asia, *i.e.* to Anatolia, "a fine country and ample enough for his needs." Sir Thomas has much to say on the future of Mesopotamia, its ultimate limits, its development, and its relations with England on the one hand and the Arabs on the other; a special chapter is devoted to Mesopotamia and Syria.

A final chapter deals with Alsace and Lorraine, which Sir Thomas maintains must be returned to France, although he doubts if the acquisition of the plains of Alsace would strengthen the French frontier in that direction.

It will be seen from this summary that Sir Thomas Holdich discusses with full knowledge some of the most important problems of world reconstruction which will have to be solved after the War has finished its work of destruction. The geographical elements of the problem are kept constantly in view, while the other elements that receive consideration are never lost sight of. No doubt any attempt at the solution of such a complicated problem is open to criticism, but so full a statement of the data of the problem ought to be welcomed by all who may have to take a hand in its actual solution.

J. SCOTT KELTIE.

REVIEWS

ASIA

Mining Enterprise in China.— **W. F. Collins.** Pp. xii. and 296. London: Heinemann. 1918. *Maps and Diagrams.* 21*s. net.*

FROM all points of view, but especially from the politico-economic, the very able Vice-Chairman of the British Chamber of Commerce in Peking has given us an admirable account of 'Mining Enterprise in China.' Chapters v.–ix. have special geographic interest, though their evidence may prove somewhat disappointing to geographers. For it is evident that, though Chinese mineral resources, especially south of Hankau and east of Peking, are undoubtedly of great value, they are *not* of undoubtedly greater value than those of similar areas elsewhere, and they may prove of considerably less value—quite apart from the fact that small-claim mining has been going on for centuries. In any case China now must turn to industrial development, and therefore must ultimately adopt foreign methods and experiences, if not actually foreign laws. In the meantime only coal (near markets) and rich deposits of metals such as zinc and antimony (historically untouched) have been able to flourish at all. In all countries large-scale mining tends to be company mining, and the Chinese as yet have not developed this, while the small claims have been more or less worked out everywhere. At the same time the Chinese objection to foreign capital and foreign engineers, as involving political influence by foreigners—though temporarily strengthened by the German policy in Shantung—is

gradually being sapped by their experience of the working, *e.g.*, of the railways in North China and of the P'ing Hsiang collieries. But the progress of any native industry is still greatly hampered, in spite of the good intentions of the 1914 Mining Law. On the general conditions Mr. Collins throws a flood of light, especially in the chapters on legislation and taxation, supplemented by several appendices (pp. 212–283).

The book is full of interesting side lights, historical and otherwise. For instance, in the eleventh century A.D. the rice officials were ordered to supply money for mining, and so came to control the mining itself as a sort of branch of agriculture—a delusion still influencing practical mining (p. 202). Coal was used for smelting iron as early as 1111 A.D. The story of the opening up of China reads most honourably for England. In the earlier days there was nothing and nobody to prevent our getting complete monopoly of all the trade; but throughout we stood firm for "the open door," and, as a matter of fact, wide encouragement of foreign capital from all sources is the best guarantee against territorial aggression or mailed-fist intimidation by any one Power.

The account of the Hanyang iron and steel enterprise, in connection with the Tagel iron-mines and the P'ing Hsiang collieries—with their cheap ore, fuel, lime, and labour, their exemption from tariff burdens, and their preferential markets—makes it clear that no other native enterprise of the kind is at all likely to succeed for years to come unless there is a drastic reform of all the conditions, political and economic. But in the meantime the prospect is least discouraging in two areas—the Hunan area, with its coal, lead, antimony, and iron, converging on the Tung-Ting Lake navigation; and the Liao-Tung area, with its gold, silver, iron, and wolfram, and coal flanking the coast almost continuously from Tientsin to Mukden. Of both areas Mr. Collins gives clear and useful maps, as also of Shantung, where, however, the mineral wealth has proved far less than the Germans anticipated. L. W. L.

Cyprus under British Rule.— **Captain C. W. J. Orr.** London: Robert Scott. 1918. Pp. 192. *Map.* 6*s. net.*

Captain Orr, who has spent several years as Chief Secretary to H.M.'s Government in Cyprus, writes with intimate knowledge and singular restraint. That he might have written a picturesque and popular volume on the sights and scenes of Cyprus is shown by his eight-page "Introduction," where he sketches in a charming manner the physical features and the life of the inhabitants of the island. He has, however, devoted the whole of this small volume to a discussion of the political problems existing there. He writes lucidly and judicially, but with honest criticism both of the British Government methods and of the Cypriote peoples. It is a timely volume, as the status of Cyprus has been entirely changed since its annexation to the British Empire on 5 November 1914, and the whole future of the island will necessarily have to be reconsidered at the conclusion of the present war.

The treaty with Turkey in 1878, which gave us the administration of the island (in exchange for conditions which, by the way, were never fulfilled), left Cyprus most unjustly saddled with a tribute to Turkey nominally—actually to the shareholders of the Ottoman loan—of over £92,000. With the increased cost of administration under Great Britain, it was soon proved that the revenues of the island could not meet such a drain, and consequently our Government had to make up an annual average deficit of £30,000, replaced since 1907 by an annual grant-in-aid of £50,000. It cannot be said, however, that this system of financial assistance from Great Britain has in any degree

contented the Cypriots or any of those who had the interests of the country at heart. Many urgent improvements have been held up through financial straits, and, as the author points out, this system of making a levy on the land for the benefit of foreign shareholders and not of the inhabitants themselves, directly or indirectly, is contrary to all our vaunted principles of fair government.

Captain Orr reviews in turn all the various branches of the administration. The judicial system, manifestly, badly needs revision. The methods of taxation and finance are most clearly and interestingly described. Education is still backward, and after the war a new settlement must be made. Up to the present the Greek (Christian) members of the Legislature have opposed any proposal to admit of teachers being Government servants, because they are as a class too valuable as agents of political propaganda among the young.

The most vital interests in Cyprus must ever be her agriculture and her forests. In both these departments progress has been slow—largely because of want of funds—but there has been considerable improvement of late. The novel laws recently made to reduce the enormous number of goats, the great enemies of the forests, have proved very useful. We have established in Cyprus a local government by a Legislative Council, which is unlike that in most Crown Colonies, and which has proved cumbersome and obstructive. There are eighteen members of the Council, of whom twelve are elected. Were it not that of these last three represent the Moslem (Turk) element, the Government nominees would be in a perpetual minority, as the Greek-speaking element seems to be in a state of chronic opposition. But it is a strange and perilous position that the British authorities have to depend upon the chronic feud between the Christians and Moslems to attain their ends. The secret of the Christian opposition tactics rests upon their chronic agitation for union with Greece. But, as the author reminds us, though "Cyprus has belonged in the past to Egypt, to Persia, to Assyria, to Rome, to Venice, to Genoa, to the Ottoman Empire, it has *never belonged to Greece*," "nor can it by the wildest stretch of imagination be said to form geographically one of the Greek islands." The Christian inhabitants, however, though of very mixed origin, are undoubtedly Greek in language and sympathy. The problem, however, of the 60,000 Turkish inhabitants who have been uniformly loyal to Britain and bitterly oppose any idea of union with Greece is one which cannot be lightly ignored. "Uncertainty as to the future of the island has been one of the most important of all the causes which have adversely affected Cyprus during the last forty years."

Captain Orr considers that our want of popularity in Cyprus is in no small degree due to our over-bureaucratic system of government and a want of wide human sympathy on the part of officials. Although modern Greek is the only language of the majority of the inhabitants, the British officials from various causes—not always their personal fault—do not speak it. But there is also a lamentable want of business initiative and co-operation among the leading Cypriots, who are more interested in "the Hellenic idea" than in advancing with single-eyed devotion the present good of their land. Finally, the author considers that "the most pressing necessity now is to bring the educated Cyriot into closer touch with the Government of the island."

Palestine and Jerusalem. (A Soldier's Handbook.)— **Rev. H. Sykes, M.A.** London: Hodder & Stoughton. [1918.] Pp. 64. *Maps.* 1od. *net.*

This very compact little book is designed to lie comfortably in any soldier's pocket. It provides just the information which an intelligent soldier, moderately conversant with the Bible, is sure to need at the Palestine front.

It also contains some excellent advice most sensibly given regarding a right attitude to the people in the area we have liberated. The two sketch-maps attached to the cover considerably add to the neat little volume's usefulness.

Syria and the Holy Land. Sir George Adam Smith. London: Hodder & Stoughton. 1918. Pp. 56. *Two coloured maps.* 1*s. net.*

This booklet contains a fascinating sketch of the main geographical features of Syria and of its position in the Near East, and is illustrated by two valuable maps coloured to show the orographical features. In about fifty pages the author deals not only with the exceedingly interesting geographical facts concerning this land but touches upon the past history, economic questions, colonization, and the very thorny political questions concerned with Palestine's future.

The blight that has fallen upon this land with the coming of the Turk is emphasized. "Save for some sporadic efforts, the Turk has been wanting in all for which a government exists—justice and security, the development of public utilities, the encouragement of industry and trade—not to speak of education." He has turned "nine-tenths of the country" into a social desert. Many do not realize that the Turk is an utter alien to Syria "with no native claim to the soil and few or no family ties to the people."

In looking to the future, the author considers that the land holds vast possibilities of development. Many districts require little but industry, settled government, and some capital to develop them. Others require skilled and special treatment. "There are steppes and arid bottoms in the land as ready to be transformed by irrigation or dry farming as similarly unpromising districts have proved in California and other Western States of America." Even with afforestation—neglected in the land for many centuries—"it does not appear that a full chance of proving its capacity as a timber-bearing country has ever been given the land."

Sir George Adam Smith points out (what is but too often being forgotten to-day) that no race demands more care from a just government than the *fellahin*—the true natives of the land—who through long centuries have borne the sorest service and suffering under the Turks. Their claim must not be forgotten in the more widely advertised "claims of the Jews." To the excellent work done by the Jewish Agricultural Colonies the author pays ample tribute, and along these lines, expanded under happier conditions, he sees a great future of development. With regard to the "political" or "national" aspirations of the Jews he, like many others, both Gentiles and Jews, foresees great difficulties. Wise statesmanship will be needed to surmount the very contentious questions concerning the claims of the various religions and the position of the "sacred sites." On the economic side, "How do Zionists propose to preserve the legal rights and secure the social health of the *fellahin* or prevent the continuation of that process of buying and crushing them out of their communal property, by which so many of them have already been reduced to the position of serfs?" And what of the native Christians—Syrian and Greek? "They doubtless claim that their faith is the moral heir of all that was best in ancient Judaism. Have not the 'living Christian Communities' been as long in possession of their portions of the land as ever the Jews were?" "In short, the Jewish question in the Holy Land cannot be decided by itself, nor merely upon general assurance that 'the rights of the creeds and races will be respected' under Jewish dominance."

The author truly states that the problems awaiting the future political

administration of Syria are "quite as heavy as those which gather along the northern and north-western frontiers of the Indian Empire." The booklet cannot be too widely read among all interested in after-war problems.

GENERAL

The Statesman's Year-Book.— Edited by **Sir John Scott Keltie**, assisted by **M. Epstein.** London: Macmillan & Co. 1918. Pp. xlviii., 1488. *Maps. Price* 18*s. net.*

An acquaintance with the 'Statesman's Year Book' extending over thirty years has led the present writer, and doubtless very many others, to look carefully at the Introductory Tables and the additions and corrections. It is only by combining this matter with that in the text that full value is got from the Year Book. The 1918 edition—the fourth volume produced in war conditions—illustrates this point. Two examples may be cited: (1) the information in respect to Russia; (2) the notes on Arabia. As to (1) the text alone is not complete or sufficiently up to date, though a laudable effort has been made to put lucidly the theoretical working of the Soviet constitution. But add the information in the Introductory Tables (which include more than tabular matter), and in the additions, and you get as comprehensive a view of Russia in mid-1918 as it is possible to obtain in an annual which takes the whole world as its province. There are for instance useful particulars concerning the Ukraine, and summaries of all the border-state treaties. As to (2) the page in which is analyzed the political condition of Arabia is most timely in view of the part the Arabs are playing in the war. It is a real help to all students of affairs in the Near East, for it puts in concise form the precise status of such states as Nejd, Asir, Koweit, the Hidjaz, etc., information not easy otherwise to find.

For the rest Sir John Keltie and Mr. Epstein deserve congratulation for the manner in which despite war difficulties information concerning belligerent states has been gathered. The articles on the British Empire, for the revising of which Mr. A. D. Webb is responsible, contains all the information that one can reasonably expect. One sometimes regrets that with regard to officials of various kinds the Year Book does not give the information to be found in the 'Almanach de Gotha.' F. R. C.

Geography of the World's Agriculture.— **V. C. Finch** and **O. E. Baker.** Department of Agriculture, Washington, U.S.A. 1917. Pp. 150. *Maps and Diagrams.*

This is a valuable compilation in a fairly handy form. Its aim is to summarize the geographical distribution of important agricultural crops, and to suggest the various controls, especially of soil and climate, in each case. It might be called a "Companion" to the various publications on the same subject issued by the U.S.A. Census officials. Experts from different Bureaus (plant industry, animal industry, farm management, etc.) contribute the text or the diagrams, and the whole is admirably edited.

The work has many merits, especially on the mechanical side; but it is scarcely an up-to-date scientific treatise on the subject, and it is very far from fulfilling all the expectations roused by the title. For instance, there is no mention of such important crops as rubber, bananas, and cacao, nor of *any* palms (coconut, sago, oil, date), or of timber. On the other hand, there are sections on, *e.g.*, mules and goats. Every section contains maps, text, and graphs. There are considerably over two hundred diagrams and two coloured maps—

of world relief and world rainfall. Unfortunately all the world maps are on Mercator's projection, and the careful warning about the exaggeration does not minimize its great inconvenience for representing distributional areas. The other maps are on polyconic equal-area projections, and practically every diagram of distribution is checked by a graph of actual production. The main basis of treatment is, quite rightly, acreage, not yield; but where the yield is of special importance, *e.g.* in the case of cotton and sugar, it is preferred. Most of the maps are based on the three-year average of 1911–1913, which seems to give quite typical returns for many crops; but for U.S.A. data the authors go back to the 1910 census—which is disappointing—and for Russian Asia the two years 1912 and 1914 are adopted. The graphs are admirably done, and great care is taken to avoid confusion from the different scales of the various maps. The unit of distribution is the smallest political or statistical division for which satisfactory figures are available, or which is feasible on the particular map.

The text is clear, interesting, and suggestive; and—as far as it goes—it is generally very accurate and always practical. But it only brings together data that are fairly well known, and leaves a good deal to be desired on several important subjects and important areas, especially on rubber and the various palms, and on the continent of Africa. For instance, in the section on wheat, which occupies nearly one-tenth of the book, there is no mention whatever of the more interesting problems, *e.g.* accumulated temperatures; and, on the other hand, there is a definite assertion (p. 15) that the limits of wheat-growing on the Canadian prairie are climatic. There is a similar ignoring of economic factors in the account of wine-growing (p. 87). Under corn (maize), where the treatment of soil and climate is thoroughly satisfactory, no mention whatever is made of South Africa, though it is represented on the general map (p. 31). In the case of cotton, there is no reference, either in the text or on the map, to any part of Africa except Lower Egypt; and, unless the printer is to blame, the account of the Madras rainfall (p. 51) is specifically wrong. The account of the rainfall favourable to sugar-beet (p. 71) is almost equally misleading, for a *dry* autumn is essential; and in neither the cane nor the beet-sugar section is there any reference to the value of salt in the soil. One regrets to have to notice these things in connection with a work that is so useful and interesting both in form and in matter, but they are scarcely trifles in a Government publication dated 1917, and they are not isolated. L. W. LYDE.

THE MONTHLY RECORD

EUROPE

Geography in Italy.

L'Italia che Scrive for June last contains a useful article on Italian geographical periodicals by Roberto Almagià. Of these the *Bollettino della R. Società Geografica Italiana* is, of course, the most important. *L'Esplorazione Commerciale*, the organ of the "Società Italiana di esplorazioni geografiche e commerciali," and *L'Africa Italiana*, published in Naples by the Società Africana Italiana, have both shown signs of increased activity of late years. They are monthlies and deal respectively with commercial and African geography from the Italian point of view. The *Archivio Bibliografico Coloniale* is a quarterly devoted entirely to the new colony of Tripoli. From the

energetic "Istituto Geografico De Agostini" of Novara comes *La Geografia, Rivista di Propaganda Geografica*, ten numbers now being published annually. The purpose of the *Rivista Geografica Italiana* is to stimulate interest in geography, more especially in the geography of Italy. It is the organ of the "Società di Studi Geografici e Coloniali," but it is quite independent. It also appears ten times during the year. The *Rivista* owes not a little of its importance to the support of the able professors of geography, notably the Marinellis, father and son, who have done so much to make Florence the leading centre of geography in Italy. In Florence also are published Giotto Dainelli's *Memorie Geografiche*, which take the form of long monographs, more especially those dealing with the geography of Italy; the *Rassegna della Letteratura Geografica*, a critical view of geographical literature; and the *Rivista di Geografia didattica*, which is concerned with the educational side of geography. All these are published under the auspices of the *Rivista Geografica Italiana*. The writer goes on to regret the absence of a periodical devoted exclusively to the geography of Italy. The publications of the Italian Alpine Club and the monthly bulletin of the "Touring Club Italiano," however, do something to supply this want.

Did Petrarch construct a Map of Italy?

On the faith of a statement by Flavio Biondio in his work 'Italia Illustrata,' (composed in 1453) it has been accepted by some (including the late Prof. G. Marinelli) that the first modern map of Italy was the *Pictura Italiæ* said by Biondio to have been constructed jointly by the poet Petrarch and King Robert of Anjou. Others have pointed out the difficulties in the way of accepting this statement, which they regard as embodying merely an unsupported tradition current a century after Petrarch's time. Among the latter is Prof. G. A. Cesareo, who based his objections principally on the apparent impossibility of reconciling with known chronology the idea of any prolonged and intimate association of the poet with King Robert, and on the absence of any mention of such a map in any of Petrarch's writings bearing on geography or in those of his contemporaries. The question has been reopened by a communication from Prof. G. B. Siragusa in the *Rivista Geografica Italiana*, vol. **25**, Fasc. I.-II., 1918. This writer holds that the statements of Biondio are so precise and definite as to make it certain that he had before him some earlier work—which *he* attributed to Petrarch and King Robert—from which it was possible to deduce the changes that had since taken place in the course of the River Po. He also seeks with more or less plausibility to suggest reasons for the silence otherwise observed as to such a work by the supposed authors, which, moreover, he considers may have been not a map, but a detailed description of Italy. Prof. Cesareo replies in the next number of the *Rivista*, upholding with some force the view that what Biondio used was a *map*, but declining to accept Biondio's unsupported testimony that it was the work of Petrarch and King Robert (or of Petrarch with the patronage and support of King Robert, as Prof. Siragusa explains the supposed co-operation). A strong point is the proof that Biondio's testimony was not to be trusted in other matters of history relating to Petrarch and King Robert. Even if the negative view is accepted, it is difficult not to believe that there existed in Biondio's time a now unknown map of Italy which, if detailed enough to prove subsequent changes in the course of the Po, must have been a document of unusual importance for its time. It is to be feared that the chances of its recovery are but small.

ASIA

Baku in History.

The recent British occupation of the oil-city of the Caspian once more brings into notice a place that has had an eventful history for many centuries. It has been described as one of the oldest cities in the Russian dominions, and has played an important part in the past struggles for supremacy in this borderland between different and antagonistic races. Its situation and excellent harbour have made it an important commercial emporium for the Caspian from early times, and it is frequently mentioned in literature from the Arab geographer Masudi (tenth century) onwards. Though it is not spoken of by Marco Polo by name, the Venetian traveller makes mention of the oil-production of this region, as also does the monk-traveller Ricold of Montecroce (died 1309), quoted by Yule. So predominant was its importance over other places on the Caspian that during the middle ages that sea was long known both to writers and map-makers as the Sea of Baku. As such ("Sea of Bacuc") it was already spoken of by Friar Odoric early in the fourteenth century, and Yule when discussing this passage quotes a record in the Genoese archives describing how a penniless adventurer from that city—Tarigus by name—had in 1374, with comrades in like case, dragged a light galley from the Don to the Volga, so reaching the "Sea of Bacu," where they enriched themselves by buccaneering exploits. On maps the place figures at least as early as 1351, the date of the Laurentian or Medicean Portolan Atlas preserved at Florence, which also shows prominently the peninsula on which the place lies. So too does the famous Catalan map of 1375. On the rough planispheres of Leardus, 1442 and 1448, it appears as "Abachu," and the Caspian as "Mare de Abachu," which thus has no connection with the Jewish prophet, as unwary students might be tempted to suppose. Fra Mauro marks the place plainly on his great map of 1459, whenceforward it of course takes its place regularly on all the maps with any claim to merit. But by reason of the long-continued adherence to the Ptolemaic representation of the Caspian with its axis from east to west, the place generally appears on the southern shore of the sea, and even when an attempt is made, as by the Elizabethan traveller Jenkinson in 1562, to rectify this mistake, the position of Baku is not improved, but it is actually carried round to the *eastern* shore. The political fortunes of Baku have been somewhat varied. In the early years of the sixteenth century it was captured by the Persians under the Safavi dynasty, but remained quasi-independent under its own Khan. Captured by General Matiushkin for Peter the Great in 1723, it was restored in 1735, but finally became Russian once more in 1809. The history of its modern development as a commercial, military, and above all an oil port is to be read in J. D. Henry's 'Baku: an Eventful History,' published in 1906. The name is explained by Egli on the authority of Lepsius as derived from the Persian *baadku*, "Mountain wind."

AFRICA

The Gateway from Algeria to Morocco.

The historic highway between these two countries passes through the gap ("trou" of French writers) which separates the Middle Atlas from the Riff highlands, and is partially barred by a col—the Col of Tuaha—formed by a ridge which runs due north and south and offers a considerable obstacle to the construction of an easy road through the gap. Another obstacle exists in the uncompromising attitude of the Riata tribe which occupies the pass and

surrounding heights, and which still maintains its independence in spite of the French occupation of Taza (10 miles east of the col) in 1914, and of Tuaha in 1916. A railway has been carried to the foot of the col from the Algerian side, but the Tuaha ridge has hitherto proved too serious an obstacle to allow of its continuation westward to Fez; for though breached by the Wed Innauen, which rises some distance to the east and flows west through the gap to the Sebu in Morocco, the defile so formed is quite impracticable as a route. The somewhat abnormal physical characters of the Taza Gap are described by Commandant Poirmeur in the *Renseignements coloniaux* (*Afrique Française*), 1917, No. 12, and illustrated by maps and diagrams. The writer enters somewhat fully into the past physical history of the Taza district, an understanding of which is, he holds, important for the correct solution of various practical questions confronting the French authorities. The most striking feature in the conformation of the district is the fact that the existing water-parting between the basins of the Algerian Muluya and the Moroccan Sebu does not coincide with the Col of Tuaha, but occurs some 25 miles to the east without any well-marked dividing line. This anomaly is explained as the result of river-capture, which has shifted the divide from the Col of Tuaha to its present position. On this view the eastern plain once extended westward as far as the col at a much higher altitude than that of the present upper valley of the Wed Innauen, and Commandant Poirmeur finds indications that such was the case in certain elevated terraces and platforms much above the level of the present stream. A small tributary of the Wed Innauen would appear to have worked its way backwards through the Tuaha ridge and in course of time reduced the level and reversed the slope of the valley to the east. The whole area is marked by immaturity of form due to the comparatively recent date of these supposed occurrences, and the steepness and instability of the middle and lower mountain slopes have to be reckoned with in any measures for the opening of a modern route—road or railway—through the gap. Special care will also be needed to take account of the abnormal morphology in constructing the detailed map of the region and in undertaking military operations therein. For the subjugation of the Riata Commandant Poirmeur urges the occupation of the upper zone of cultivable ground which fringes the highlands and is the remnant of the ancient high-level plain above spoken of. He regards the extension of the railway across the col as merely a matter of time, though presenting undoubted difficulties.

The Level of Lake Nyasa.

In his recent paper on "The Backbone of Africa" (*Geographical Journal*, September) Sir Alfred Sharpe referred to the fall in the water-level of Lake Nyasa, which prior to 1915 had been continuous for many years. We are informed that since 1915 the fall has ceased, and has been succeeded by a rise, the low-water level of the lake at the end of the dry season being in 1917 3 feet 10 inches, and the high-water level at the close of the rainy season in that year being 3 feet 5 inches higher than they were at corresponding dates in 1915. This rise has not been sufficient to render the Shire River at its exit from the lake navigable, except for barges, owing to the growth of weeds and silting-up which have occurred during the years in which the lake was falling.

AMERICA

A Journey round the whole Arctic coast of Alaska.

We have been favoured with the copy of a letter written by Archdeacon Stuck at Fort Yukon, Alaska, in June of this year, describing a journey made by him

last winter round the whole Arctic coast of Alaska—a *tour de force* even more remarkable than the ascent of Mount McKinley (see *Journal*, vol. 43, p. 83) by which the archdeacon has hitherto been best known to geographers. The journey, which naturally involved no small amount of hardship, afforded an unrivalled opportunity for gaining acquaintance with the Eskimo throughout the great stretch of country traversed, as well as for a comparative study of the work carried on among them by the various Christian organizations busy in that remote region. These Eskimo, the writer says, are "surely of all primitive peoples the one that has the greatest claim to the generous consideration of civilized mankind. Where else shall a people be found so brave, so hardy, so industrious, so kindly, and withal so cheerful and content, inhabiting such utterly naked country lashed by such constant ferocity of weather?" Everywhere he received from them the greatest possible help and kindness, and brought away the warmest feeling of admiration and friendship. The start was made on the west coast first made known to the world by Cook and Kotzebue, Beechey, Collinson and Bedford Pim, and here it was possible to find some habitation, usually an underground igloo, on every night but one of the journey. Storms were encountered, but they were commonly fair winds and there were no special hardships, travelling being far more rapid than is usual in the interior. At Point Barrow a halt of two weeks gave opportunity for the study of the largest Eskimo village in Alaska. In spite of the advancing season the difficulties increased with the resumption of travel, March being the month in which the severest weather is to be expected here. Throughout the 250 miles to Flaxman Island the party saw only one human being and were housed only twice. "It is," says the writer, "the barrenest, most desolate, most forsaken coast I have ever seen in my life: flat as this paper on which I write, the frozen land merging indistinguishably into the frozen sea; nothing but a stick of driftwood here and there, half buried in the indented snow, gives evidence of the shore." The fortnight's travel along this stretch was a constant struggle against a bitter north-east wind with the thermometer 20° to 30° below zero Fahrenheit, and at night, warmed only by the "primus" oil cooking stove, the air within their little snow house was as low as from 48° to 51° below zero. The almost ceaseless wind was a torment, and the faces of all were continually frozen. There are Eskimo on the rivers away from the coast, but it was impossible to visit them. East of Point Barrow all the dog-feed had to be hauled on the sledge, and—for the first time since the archdeacon had driven dogs—they occasionally went hungry when there was no driftwood to cook with. The heaviest task however came on the journey inland to Fort Yukon. Beyond the mountains the winter's snow lay unbroken, and for eight days a trail down the Colleen river had to be beaten out ahead of the dogs. At the confluence of the Colleen with the Porcupine Stefánsson and his party were met with, escorted on the way to Fort Yukon by Dr. Burke of the hospital there. Stefánsson had lain ill all the winter at Herschel Island, and would never have recovered had he not finally resolved to be hauled 400 miles to the nearest doctor. He had, however, quite recovered by the date of the letter, and his return to civilization after five years' continuous absence has now been announced (see his letter in the present number).

AUSTRALASIA AND PACIFIC ISLANDS

A Voyage to Guam in 1801.

A short but interesting journal of a voyage to Guam in the Ladrone or Marianne Islands, Western Pacific, is printed for the first time in the *Historical*

Collections of the Essex Institute (Salem, Mass.), vol. 53, No. 3, July 1917, with notes by Mr. L. W. Jenkins. The journal—preserved among the papers of the East India Marine Society of Salem in the Essex Institute Library—was kept by William Haswell, first officer of the barque *Lydia* (Moses Barnard, master), which after a voyage from Boston to Manilla was chartered (October 1801) to take the new Spanish governor of the Mariannes to Guam, arriving there only on 5 January 1802 by reason of baffling winds and currents. The journal contains some shrewd and caustic remarks on the incidents of the voyage. Mr. Haswell came of a seafaring family, his two elder brothers serving in the U.S. navy, whilst his father and uncle had been in the British navy, the latter being the Robert Haswell whose narrative of voyages to North-West America in 1788–89 was printed by Dr. C. F. Newcombe in 1914 (see *Journal*, vol. 46, p. 391). The *Lydia's* crew numbered but eleven, though somewhat to Mr. Haswell's disgust the passengers were twenty-four, including the governor with his family and servants, a friar and his servant, and a judge and his two servants—"to many idlers to drink water and to my certain knowledge they would not have fought had we been attacked." (This refers to the risk from natives to which the ship was exposed in those dangerous waters, and against which the voyagers seem to have been but inadequately protected.) The passengers, Mr. Haswell remarks, caused a great deal of trouble. They were also in the greatest consternation, when the ship was becalmed near the land, "for fear of being taken and put to death in the dark and not have time to say their prayers." At Zamboanga, the Spanish fort in Mindanao, a stop of six days was made after the ship had been with difficulty brought to anchor in the teeth of an 8-knot current. This the writer considers to be a natural protection to the place, which had been unsuccessfully attacked by two English frigates in 1798. It was but a poor place for a ship to get supplies at, for, in the words of the governor's wife, there was "plenty of cocoa nuts, water, and girls, but nothing else." The further passage was tedious: the friar praying day and night, but all would not bring a fair wind." Arrived at last at Caldera—the harbour of Agaña in Guam, of which a plan is given—they put their passengers ashore, and while discharging cargo and filling up wood and water Mr. Haswell used to take his gun and wander into the woods, but the underbrush was so dense that he only secured in all "one small deer and some small hogs and a few birds, amongst which was a large bat near 3 feet from tip of wing to wing." The natives were hard at work with the tobacco, which, being the king's property, had to be carried to the governor, who sold it at an enormous price. During the stay help was given to an English ship in distress, and the crew of the latter in turn helped with the stowing of supplies, which were provided in such profusion at the king's expense that three-quarters could be given away to the Englishmen. The journal includes a description of Guam and its inhabitants, their manners and customs, government, and so forth, and is embellished by some effective sketches by the author.

GENERAL

Some Recent Acquisitions for the Library and Map Collection.

The liberality of Mr. Yates Thompson has once more brought some interesting additions to the Society's collections. One is an illuminated chart, on parchment, of the coasts of the Mediterranean and Western Europe, by a member of the well-known family of Oliva (originally Olives), who migrated from Majorca to Italy and worked as chart-makers during the greater part of

the sixteenth and seventeenth centuries (cf. *Journal*, vol. 33, p. 342). Their charts were the lineal successors of the old Portolan charts which so long served the practical needs of seamen, and which continued to be made, long after printed maps and charts had come into general use, as an ornate furniture for the libraries of the wealthy. The present specimen is in excellent condition, and bears the inscription "Placitus Caloirus et Oliva fecit in nobili urbe Messane, año 1617."* It is remarkable for the *duplication*, with but slight variation, of the portion concerned with the Mediterranean coasts, while the Atlantic coasts are shown independently, though with no dividing line, at the left-hand side of the chart. Another interesting gift from the same donor is that of copies, dated 1556 and 1558, of the map of the British Isles, engraved in Italy after the original by George Lily, whose monogram appears on the earliest known specimen, of 1546, preserved in the British Museum. This map was the first printed map of these islands to give a fairly correct representation of the outline of Scotland, though the means by which such an approximation was attained is unknown. It was revised at various dates, and included in Lafreri's famous Atlas. The two versions now presented are almost exactly alike in substance, but the later of the two was entirely re-engraved on a somewhat larger scale, with slightly more ornamentation, and intended to be read with the west, not the north, at the top. In view of the question sometimes raised whether the name "Britain" includes Ireland, it may be noted that in these maps it is distinctly reserved for the larger island only. Other acquisitions have been made at book sales, of which several during the summer were specially important from the point of view of geography. The seventh portion of the great Huth Library was disposed of early in July, and various early works of travel and geography fetched unusually high prices, justified, no doubt, by the exceptional condition of the copies offered.† The Society secured, through Mr. H. N. Stevens, a copy of the rare small quarto Atlas of America by the French cartographer Nicholas Sanson. It is one of four similar volumes devoted to the four larger continents, of which the library already possessed those on Europe and Africa. These volumes consisted of both maps and descriptive text, and were among the earlier productions of their author, anticipating by some years the larger general atlases by which he is best known Each ran through several editions, the America volume first appearing in 1556, and being revised in 1657, 1662 and 1667 (?). Our copy has a title-page dated 1662, but the maps all bear the date 1657. It may be noted that the volume contains an early mention, in the chapter on Paraguay, of the great Guayra falls on the Paraná River. Copies have also been secured of the first English edition (1708) of François Leguat's 'New Voyage to the East Indies,' containing a detailed account of his experiences in the islands of

* The latest issue of the *Boletin* of the Madrid Geographical Society contains facsimile reproductions of (1) a chart of the Mediterranean and Atlantic coasts of Europe and North Africa by Joan Olives of Messina, dated 1591; (2) one of the Western Mediterranean coasts by Franciscus Oliva of Marseilles, dated 1661.

† The geographical rarities included: Raleigh: 'Discovery of . . . Empyre of Guiana,' 1596 (£32); Regnault: 'Discours du Voyage . . . au Sainct Sepulcre de Ierusalem,' 1573 (£54); Robson: 'News from Aleppo,' 1628 (£10); Schiltberger: 'Wunderbarliche unnd kurtzweilige History, wie S. . . . von der Türcken gefangen . . . ist, *circ.* 1554 (£15); Schmidel: 'Vera historia . . . Navigationis . . . in Americam,' 1599 (£15); and the following by Capt. John Smith: 'Description of New England,' 1616 (£200); 'Generall Historie of Virginia,' 1624 (£210), 1631 (no other copy known) (£450); 'True Travels,' 1630 (£92); and 'Sea Grammar,' 1627 (£149).

Rodriguez and Mauritius, with descriptions and quaint cuts of their remarkable fauna and flora; and of Le Huen's adaptation (with additions describing his own experiences) of Breydenbach's famous 'Perigrinationes in Terram Sanctam.' This copy is of the third edition, 1522. Lastly, a complete set has been acquired of the great French 'Description de l'Egypte,' based upon the work of the French scientific men sent to Egypt by Bonaparte at the time of his intervention in that country.

First Herbertson Memorial Lecture.

We are informed by the Secretary of the Geographical Association that their project for founding a Memorial Lectureship in memory of the late Prof. Herbertson has made such progress that they have been able to invite M. Schrader to deliver the first lecture in Oxford on November 5, probably at 5 p.m. Members of this Society who wish to attend are invited to send a stamped addressed postcard to the Clerk, Geographical Association, 1, Marine Terrace, Aberystwyth, for the details, which are now in process of final arrangement. M. Schrader is well known to geographers by his *Atlas de géographie historique*, and his continuation of the *Atlas universelle* of Vivien de S. Martin, and for his more recent enterprise in the re-afforestation of French mountain slopes which had become desert through over-cutting and the pasturing of goats and sheep. We understand that the fund for the endowment of the lecture, to which this Society has recently contributed, remains open, and that further subscriptions are required to complete it. They may be sent to the Clerk at the above address.

OBITUARY

Brigadier-General E. W. Cox, D.S.O.

BRIGADIER-GENERAL Edgar William Cox, D.S.O., was accidentally drowned in France on 26 August 1918. General Cox was born on 9 May 1882, and received a commission in the Royal Engineers on 21 December 1900. He was promoted Captain on 10 December 1910, Brevet-Major 3 June 1916, Major R.E. 2 November 1916, Brevet Lieut.-Colonel 1 January 1917, Brevet Colonel 1 January 1918, and temporary Brigadier-General 24 January 1918.

At the Royal Military Academy he was head of his batch, and won the Queen Victoria Gold Medal and the Pollock Memorial Medal. At the School of Military Engineering he was awarded the Haynes Memorial Medal. He took a keen interest in survey work, and immediately on leaving the School of Military Engineering he was employed on the Anglo-Liberian Boundary Commission from December 1902 to October 1903, and on the Anglo-Portuguese Boundary Commission from February 1904 to March 1906. He then joined the Survey of the East African Protectorate, where he remained till January 1909. On his return to England in 1909 he was employed on military duties at Aldershot till May 1912, when he joined the Geographical Section of the General Staff at the War Office, and he was so employed on the outbreak of the war in August 1914. During these busy years he had found time to perfect his knowledge of French and German, and was an interpreter in both those languages. On the outbreak of war he was at once selected for work on the Intelligence Staff, and went to France in that capacity with the first expe-

ditionary force. It had been his intention to go to the Staff College had not the war intervened, but it was soon evident that the lack of the Staff College training was no drawback in his case. He was soon noted as one of the most brilliant officers on the staff, and his rise was rapid. At first only attached to the staff he became successively General Staff Officer 3rd Grade, 2nd Grade, 1st Grade, till finally he was selected for the position of head of the Intelligence branch of the General Staff in France, which position he held till the day of his death.

In the course of the present war the nation has had to mourn many young and brilliant men, but it may safely be said that it has suffered no more grievous loss than in the death of General Cox. He was a man of untiring energy both physically and mentally, and being a very quick worker he got through an immense amount of work, and his work was of the highest quality. He was equally efficient at survey work of all kinds, or staff work, or at the ordinary work of an engineer officer. He was one of those men, and there are very few, of whom nothing but praise was ever heard. His name was a byword for efficiency. He had great confidence in himself, but was most unassuming. He was full of enthusiasm for the job in hand, whether it was a heavy piece of work or a football match. He never wasted time. He had a most cheerful and lovable disposition.

It is a matter for infinite regret that he should have met with an accidental death when he had just reached, at a very early age, a position which gave full scope for his abilities. If his life had been spared he would surely have attained to the highest positions. He leaves a widow and two children.

W. C. HEDLEY.

To Colonel Hedley's tribute to General Cox's ability as a soldier we should like to add some expression of the loss to geography which his tragic death has occasioned. General Cox was one of the British representatives at the International Map Conference held at Paris in December 1913, and his colleagues will remember with admiration the extraordinary ability, energy, and tact with which he carried through the work especially allotted to him, the discussion of the conventional signs sheet. Unhappily, by reason of the war this work is still unpublished.

General Cox had been a Fellow of the Society for sixteen years, and for several years a member of our Diploma Committee. He was largely responsible for the second and much enlarged edition of Colonel Close's well-known 'Textbook of Topographical Surveying,' and in this, as on his boundary work, he displayed all the talents of a first-rate scientific geographer. Those who have been associated with him in this Society share with his colleagues on the General Staff the sense of sorrow at the loss of one of those rare men who may truly be called irreplaceable.

CORRESPONDENCE

The Nomenclature of Himalaya Peaks

IF a name be given to each Degree Chart as suggested by Sir S. Burrard, and the method of lettering and numbering indicated be followed, it would

certainly be difficult to devise a more convenient and scientific system. The remark that the new Degree Sheet shows nothing but numbers and the rays of triangulation, whereas the old chart showed in outline the principal rivers and glaciers, seems however to indicate a retrograde step. The average amateur geographer would probably not only wish to have the rivers and glaciers indicated, but would prefer the rays of triangulation in a different colour (say red), if it did not unduly add to the expense of production.

Colonel Burrard's suggestion that a catalogue of Himalayan peaks should be prepared seems worth carrying out, but a double catalogue, such as described in the *Journal*, seems hardly necessary at the outset. Probably all that would be required would be a revised and considerably enlarged edition of Burrard and Hayden's book, 'The High Peaks of Asia.' In that volume the peaks are tabulated according to height in magnitudes of 1000-feet range, the longitude and latitude and regional name being given. All known peaks above 24,000 feet are summarized, the mountains between 24,000 and 25,000 feet forming the sixth magnitude. The tables might be extended so as to include peaks down to the tenth magnitude (20,000 to 21,000 feet). Even if there were a few thousand mountains in this last group, there should be little difficulty in picking out any particular peak, as the name of the Degree Sheet would be a guide.

Below the tenth magnitude the number in any group would be very large, but it might be sufficient at present to give a supplementary table of peaks of any importance, *e.g.* Jubonu, Narsing, Haramukh, which later on might be amplified and subdivided.

Perhaps I may also be permitted a few notes on nomenclature, as my ideas differ somewhat from those of Colonel Burrard and yourself. In the first place I do not agree that the time has come for regarding the name "Everest" as a suitable designation for the loftiest mountain of the whole system. As already indicated (*Geog. Journ.*, 1917, p. 46), the name "Chomo Langmo" has been independently found by General Bruce and the writer to be applied to the mountain, and until this name has been tested it would be advisable to refrain from a decision. In any case one would prefer to see a Tibetan or Nepalese name applied to the mountain, and Dr. Freshfield's contention that personal names should not be used in the Himalaya is supported by Colonel Burrard except in this particular case. To make an admirable rule and then deliberately break it as regards the chief summit of the whole system seems hardly consistent, and the reasons cited seem inadequate.

Again, as regards K_2, which will now be designated by the unsatisfactory appellation 52 A/13, it might be desirable to consider the application of a name derived from the natives of Baltistan. The merits of names already mooted, *e.g.* Chiring (Sir M. Conway) and Dapsang (Schlagintweit), might be debated once more by a few experts. The headmen of the nearest villages could then be informed of the name finally decided upon. The statement that "the symbol K_2 will serve to record the interesting fact that a mountain exceeding 28,000 feet in height had not been deemed worthy of a name by the people living under its shadow" is somewhat figurative, for Hill Burton's phrase regarding a much smaller mountain—"surrounded by his peers he stands apart from the world in mysterious grandeur"—is truly applicable to the premier peak of the Karakoram.

The application of special descriptive names like Pyramid, Hawk, etc. would of course be less objectionable if translated into the native language used near the base of the mountain, *e.g.* Tibetan and Nepalese. Prof. Gar-

wood gives a summary of such descriptive names used in Freshfield's 'Round Kangchenjunga,' along with Tibetan equivalents, in a supplement to that book. There would naturally in many cases be several peaks with the same designation, but this need cause little difficulty if the name of the Degree Sheet were employed for distinction. In Scotland there are often several mountains with the same name, *e.g.* Ben More. The name when unqualified indicates the highest peak (Perthshire). In the other cases a qualifying local name is applied, *e.g.* Ben More of Assynt, Ben More in Mull.

Lastly, might I be permitted in the interests of Himalayan nomenclature to venture a remark regarding the statement in connection with Kanchenjunga in Burrard and Hayden's volume, that the most recent term applied, namely Kinchinjunga, should be adopted, although probably incorrect etymologically, because "uniformity in spelling is of more importance to geographers than correctness." I must take the liberty of disagreeing in this respect, as I fail to see that there is any excuse for mutilating a good name—and Kangchenjunga is an admirable designation—so that its meaning becomes unintelligible. Presumably it would be possible to secure both uniformity and etymological exactitude. Kinchinjunga is obscure because the first two syllables are derived from the Tibetan words "Kang," snow, and "chen," great. Kangchenjunga therefore seems etymologically to be by far the better term. Dr. Freshfield, in his book on the circuit of the mountain, states that he selected the name from fourteen variants. The selection of one definite name is certainly important. In 1903 three of the names which had been used for the mountain, namely Kangchenjunga, Kangchanjunga, and Kanchinjinga, appeared simultaneously in different survey maps.

Might one suggest that all Asiatic place-names should be submitted before adoption to linguistic experts, who would determine the etymology when possible, and crystallize the spelling and pronunciation.

A. M. KELLAS.

[We are glad to publish Dr. Kellas' letter as the first contribution to that discussion of Sir Sidney Burrard's note which we invited on its publication.

We would add that the present Director-General found himself confronted with an accomplished fact in the case of the name for Mount Everest, and cannot well be held responsible for the single exception to the principle upon which he has acted.—ED. *G. J.*]

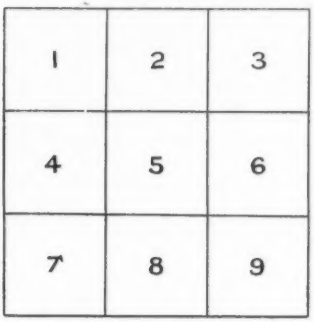
The Designation of Points on Maps.

I have read with much interest the article in the September number of the *Journal* on "The Identification of Peaks in the Himalaya," and feel sure that there will be a general agreement that it is desirable to give a name to each degree chart, as proposed by Sir Sidney Burrard, and think that, on the whole, the system proposed by him is simple and practical. But there seems to be some doubt as to the actual procedure followed in giving the peaks numbers, and I venture to suggest a possible system which would not only apply to this particular problem but might also have some utility in other cases.

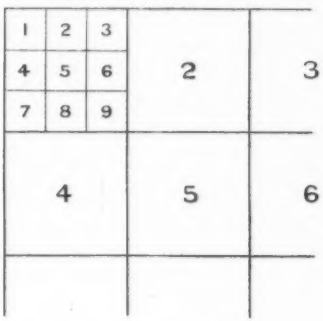
The suggested system is the following: Imagine each side of a map to be divided into three equal portions, and join the opposite corresponding divisions by straight lines. Then the map is partitioned off into nine approximately

equal cells. Number these cells as shown. Now, suppose that each of the cells is similarly divided:

FIRST ORDER CELLS.

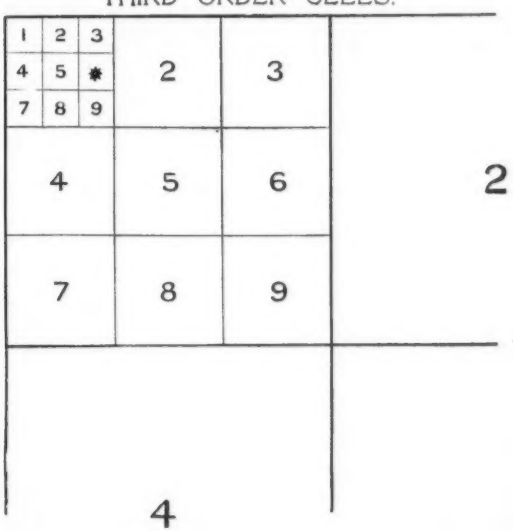


SECOND ORDER CELLS



and let each second-order cell be similarly divided, thus:

THIRD ORDER CELLS.



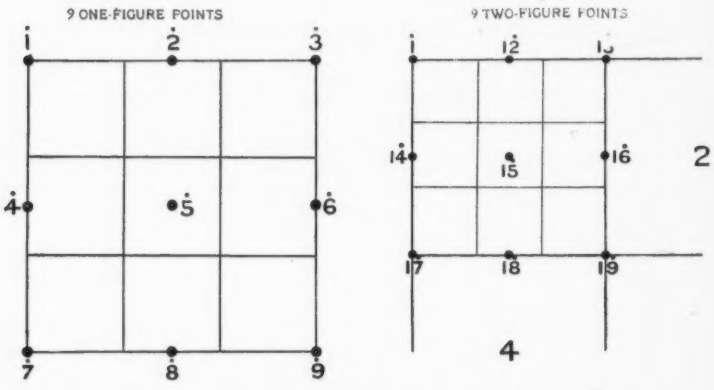
and so on.

Then let us, by convention, describe a cell of any order by a number of which the first figure is the number of the first-order cell in which it lies, the second figure the number of the second-order cell, and so on. Thus the cell marked * in the above figure is 116. The map is thus imagined to be divided into 9^n cells, where n is the number of orders used. In the case of three order

the number of cells is 729, and if a degree sheet is about 4200 square miles in area, the area of each cell will be a little less than 6 square miles. With two orders the area of each cell will be 50 square miles ; with four orders, about $\frac{2}{3}$ square mile, etc. For the case of the Himalayan peaks a 2-order cell would no doubt be sufficient.

This system can conveniently be used where areas require identification, and, in the case of mountains, it is sometimes not only the highest peak that requires locating but the mountain itself, or the group to which it belongs.

But sometimes it is necessary to determine, by some system, the position of an actual point. This can be done, of course, by co-ordinates, but only to the degree of accuracy allowed by the unit of measure of the co-ordinates. With the same kind of accuracy the cell system can be employed if we use the symbol for a recurring number ; $\dot{4}$, for instance, represents 444 . . . *ad infinitum*, and by our convention this implies cell inside cell, always approaching the middle point of the left side of the map, until at the limit this point is reached. $\dot{4}$ therefore means the middle point of the left side of the map.



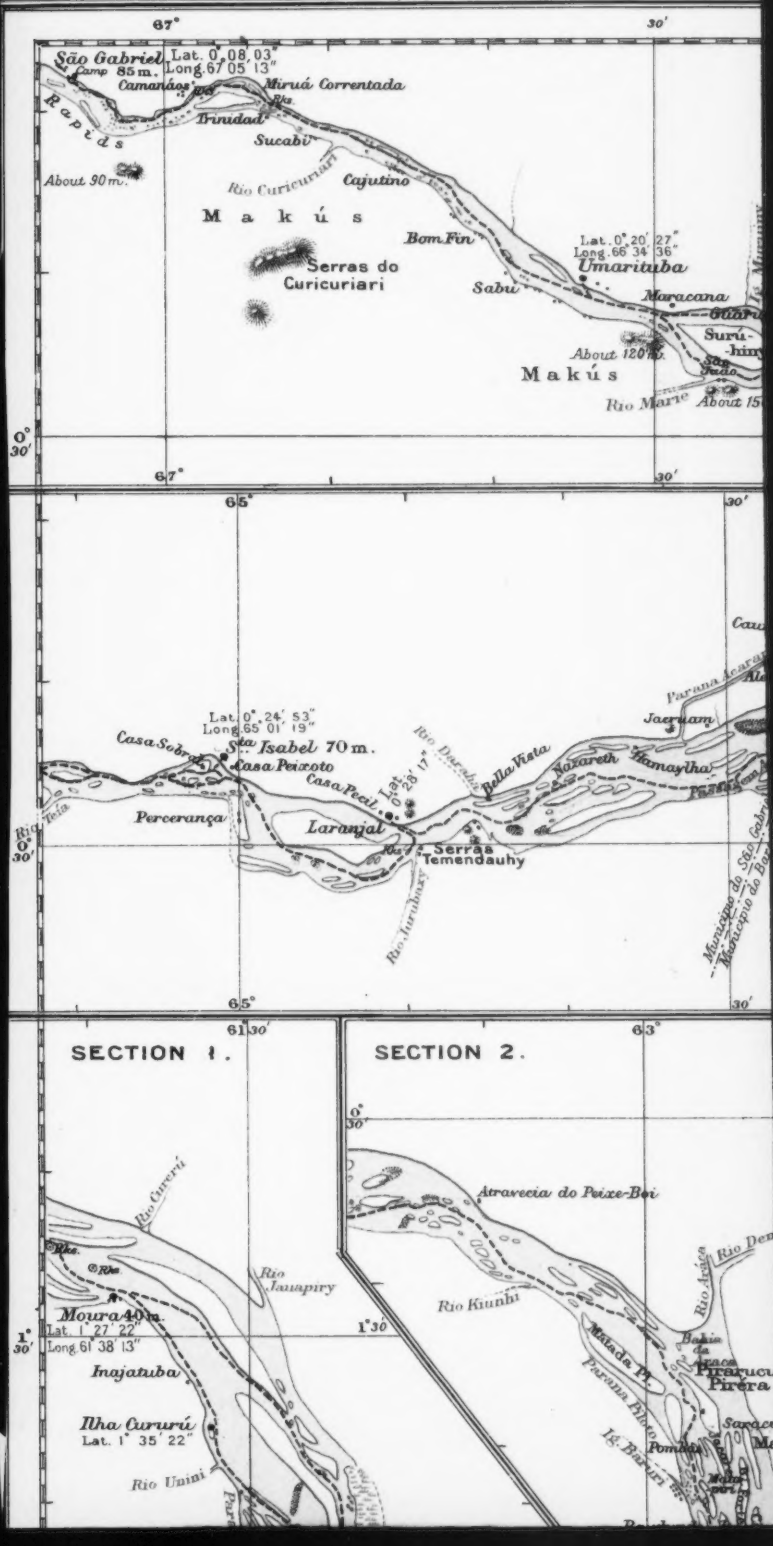
In the same way $1\dot{4}$ means the middle point of the left side of cell 1, and $12\dot{4}$ means the middle point of the left side of cell 2 of cell 1, and so on.

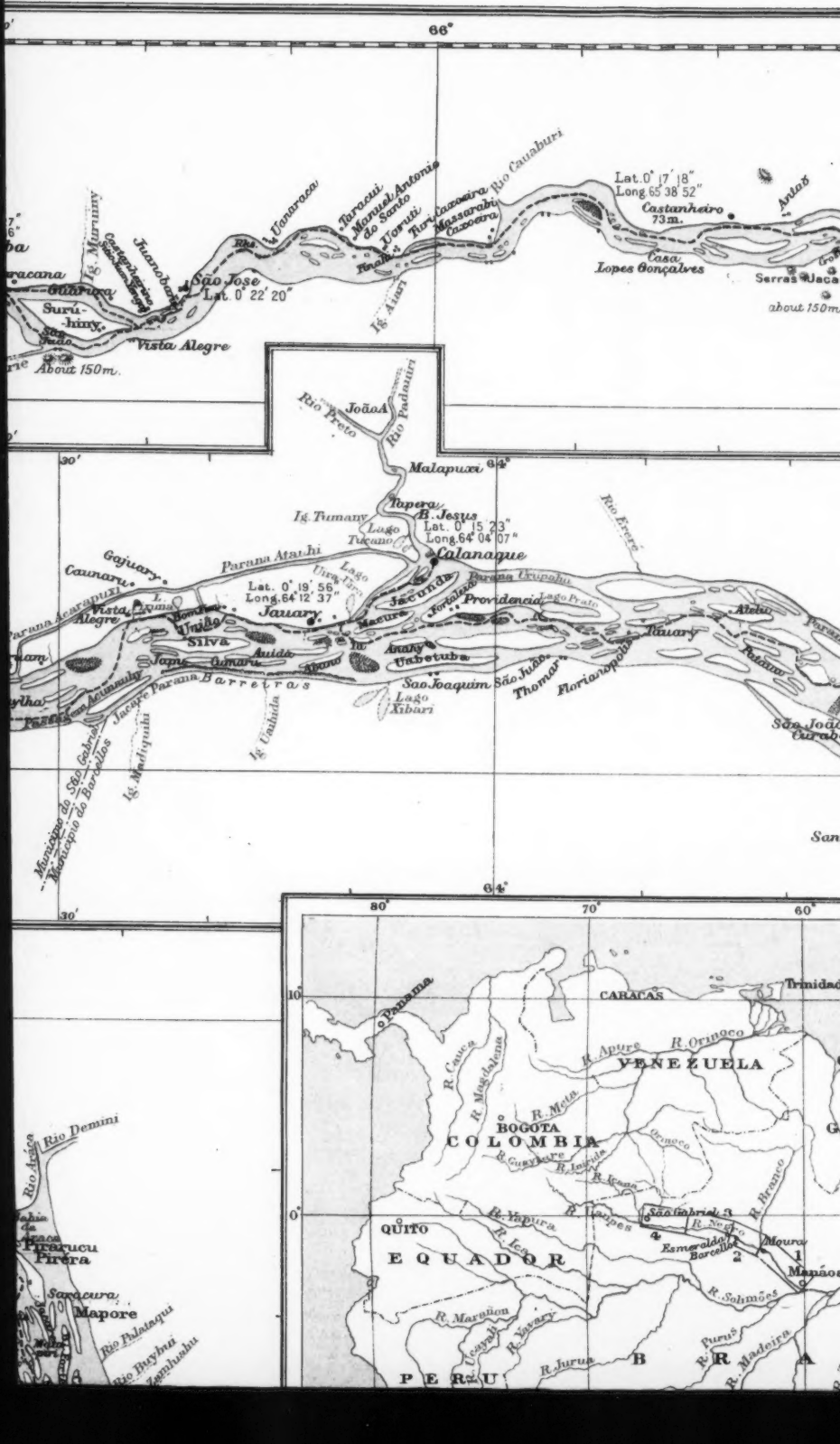
There are also "two-dot" numbers of two or more digits. Of the former, such as $2\dot{4}$, there are 72 with different digits, or 81 if we include the numbers $1\dot{1}$, etc., which are equivalent to the "one-dot" numbers 1, etc. The two-dot points, such as $1\dot{2}$, $1\dot{3}$, $6\dot{2}$, $5\dot{4}$, etc., divide the map each way into eighths, and are at the corners of 64 similar spaces.

The cells and points can both be used if required. Some of the points can be described in more than one way ; thus $1\dot{9}$ is the same as $2\dot{7}$, or $4\dot{3}$, or $5\dot{1}$. It might be as well always to use the description beginning with the smallest number. But each description is definite, and the use either of cells or points can be applied to any four-sided map.

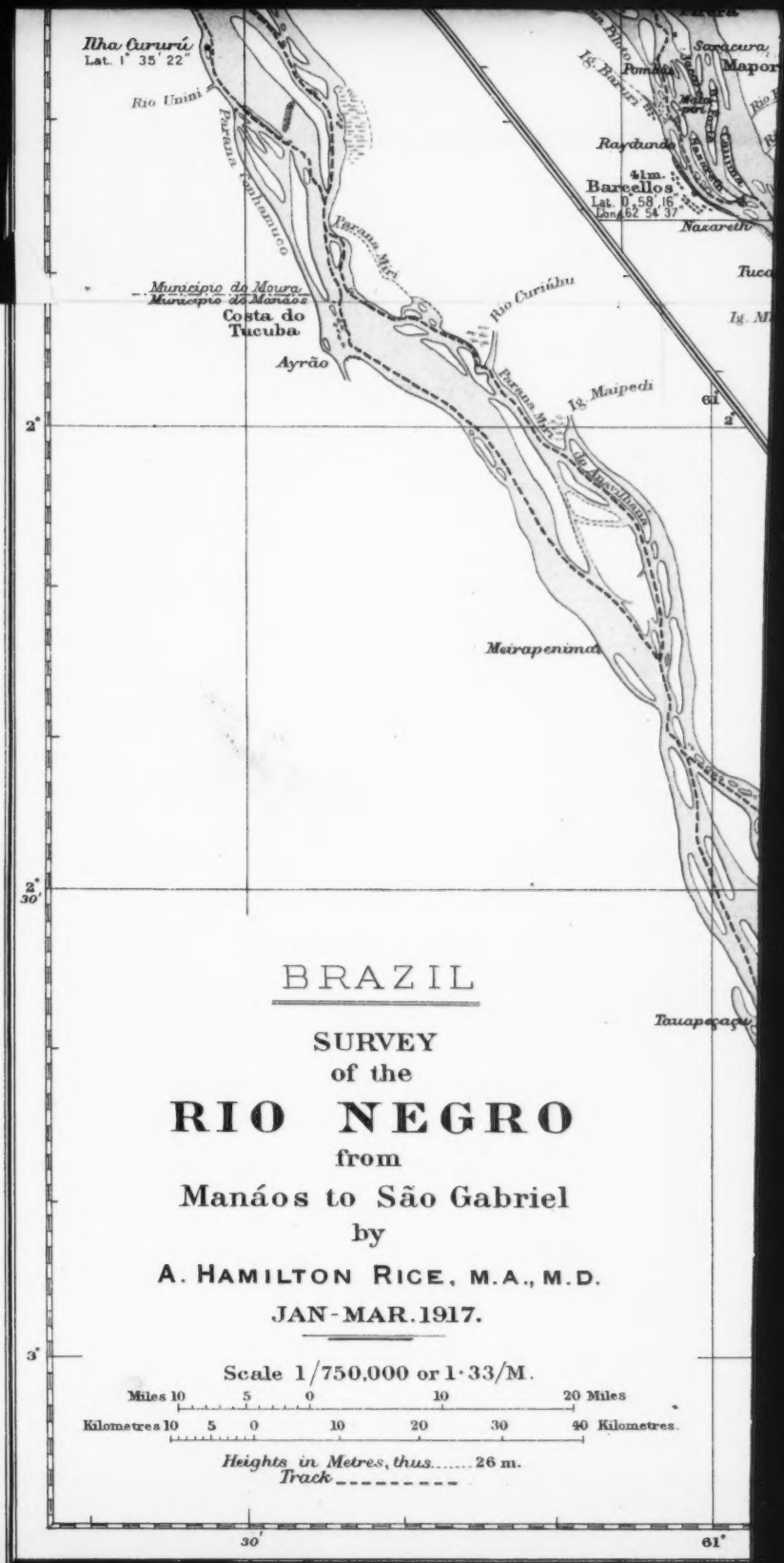
C. F. CLOSE.

Southampton, 13 September 1918.


67°
30'
São Gabriel
Camp 85 m.
Lat. 0° 08' 03"
Long. 67° 05' 13"
Camanáos
Miruá Correntada
Rapids
Trinidad
Sucabi
About 90 m.
Rio Curicuriari
Cajutino
Makús
Bom Fim
Serras do
Curicuriari
Lat. 0° 20' 27"
Long. 66° 34' 36"
Umarituba
Sabu
Maracana
Surú-
hin
About 120 m.
Makús
Rio Marie
About 15
0°
30'
67°
30'
65°
30'
Lat. 0° 24' 53"
Long. 65° 01' 19"
Sta Isabel 70 m.
Casa Sobral
Casa Peixoto
Casa Pecal
Lat. 0° 28' 17"
Rio Daraha
Bella Vista
Nazareth
Itamaylha
Jacruam
Parana Acara
Perceranca
Laranjal
Serras
Temendauhy
Rio Jurubaxy
Rio
0°
30'
65°
30'
61°30'
SECTION 1.
Rio Curicuri
Rio Jauapiry
Moura 40 m.
Lat. 1° 27' 22"
Long. 61° 38' 13"
1°
30'
Inajatuba
Ilha Cururú
Lat. 1° 35' 22"
Rio Unini
63°
SECTION 2.
0°
30'
Atravecia do Peixe-Boi
Rio Kiunhi
1°30'
Rio Arácá
Matada Pt.
Parana Ubim
Pirarucu
Pirera
Pomba
Ig. Barauri
Rio


66°
Lat. 0° 17' 18"
Long. 65° 38' 52"
Castanheiro
73 m.
Lopes Gonçalves
Serras
about 150 m.
São José
Lat. 0° 22' 20"
Vista Alegre
About 150 m.
Rio Preto
Rio Padauiri
Malapuxi
Tapera
B. Jesus
Lat. 0° 15' 23"
Long. 64° 04' 07"
Calanaque
Rio Erere
Gajuary
Caiuaru
Parana Atai-hi
Lago Tucano
Lat. 0° 19' 56"
Long. 64° 12' 37"
Jauary
Jacunda
Providencia
Parana Urupahu
Lago Prato
Vista Alegre
Unida
Silva
Auidos
Amary
Uabetuba
Thomar
Florianopolis
Barreiras
São Joaquim
São Judo
Lago Xibari
Rio Demini
Rio Araca
Pirarucu Pireira
Saracura
Mapore
Rio Jatapu
Rio Inyhu
Zamhuhu
64°
30°
80°
70°
60°
10°
0°
Panama
CARACAS
Trinidad
R. Orinoco
R. Apure
VENEZUELA
R. Cauca
R. Magdalena
R. Meta
BOGOTA
COLOMBIA
R. Guaviare
R. Isanna
R. Xingu
R. Tapajoz
R. Negro
R. Branco
São Gabriel
Moura
Manáos
QUITO
EQUADOR
R. Yapura
R. Iça
R. Solimões
R. Maranhon
R. Yavary
R. Jurua
R. Purus
R. Madeira
PERU
BRA

30'
SECTION 4.
Chico Herrera
Maraunhiá
Rio Maraunhiá
Rio Teiá
0°
30'
SECTION 3.
Parana to Lago Jacunra
Lat. 0° 26' 59"
Long. 63° 30' 54"
São João
Curuba
Arara
Santa Anna
Moreira
Esmeralda
61 m
Lat. 0° 36' 20"
Long. 63° 21' 40"
60°
50°
Scale 1/30,000,000 or 1/30 M.
Miles
Kilometres
Trinidad
10°
Georgetown
Paramaribo
Cayenne
GUIANA
R. Amazon
Para
Manãos
R. Tapajos
R. Iriri
A Z I L



BRAZIL

SURVEY
of the
RIO NEGRO
from
Manáos to São Gabriel
by

A. HAMILTON RICE, M.A., M.D.

JAN-MAR. 1917.

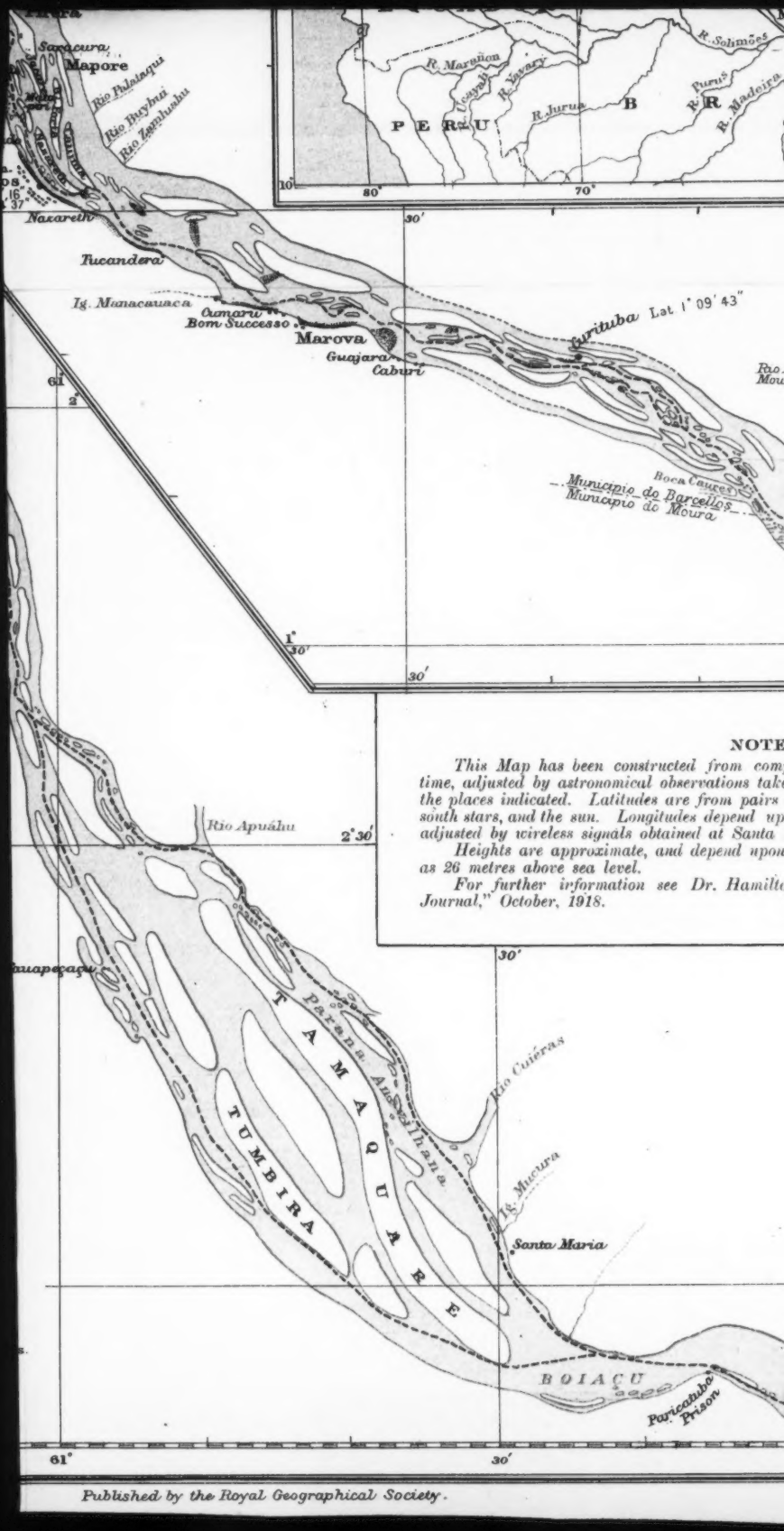
Scale 1/750,000 or 1·33/M.

Miles 10 5 0 10 20 Miles

Kilometres 10 5 0 10 20 30 40 Kilometres.

Heights in Metres, thus.....26 m.

Track ---------



NOTE

This Map has been constructed from com time, adjusted by astronomical observations tak the places indicated. Latitudes are from pairs south stars, and the sun. Longitudes depend up adjusted by wireless signals obtained at Santa

Heights are approximate, and depend upon as 26 metres above sea level.

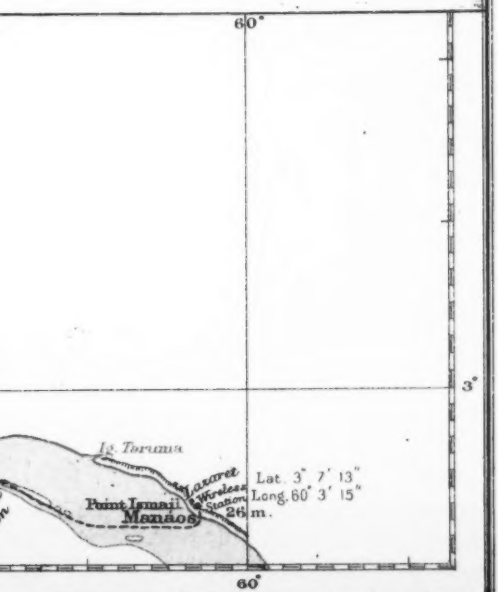
For further information see Dr. Hamilt Journal," October, 1918.

Published by the Royal Geographical Society.

NOTE.

rom compass traverses and distances by log and ations taken with a 6-inch micrometer theodolite at om pairs of circummeridian altitudes of north and epend upon chronometric differences from Manáos, nt Santa Isabel and Esmeralda.
pend upon aneroid differences from Manáos, taken

. Hamilton Rice's paper in the "Geographical



RIO NEGRO
Hamilton Rice.